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NISTAR Data Format Control Book Specification

May 28, 2020

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DSCOVR PROJECT

DOCUMENT CHANGE RECORD

REV LEVEL	DESCRIPTION OF CHANGE	APPROVED BY	DATE APPROVED
Rev-	Initially released by DSCOVR Science Team		
Rev-A	Released by L-1 Standards and Technology, Inc. The content has been updated to adapt to the latest format of NISTAR Version 2.1 data, and to provide more detailed and rigorous guidance for users.	S. Lorentz	4/1/2019
Rev-B	Released by L-1 Standards and Technology, Inc. The content has been updated to adapt to the latest format of NISTAR Version 3.0 data, which features a digital filtering scheme to reduce the instrument noise.	S. Lorentz	5/28/2020

List of TBDs/TBRs

Item No.	Location	Summary	Ind./Org.	Due Date

TABLE OF CONTENTS

LIST OF FIGURES

Figure Page

No table of figures entries found.

LIST OF TABLES

Table Page

1 INTRODUCTION

1.1 IDENTIFICATION

This document is the Data Format Control Book (DFCB) for the DSCOVR NISTAR instrument science data products. It describes the two levels of data products and defines their contents. Both products are written in the Hierarchical Data Format 5 (HDF5) standard and are archived at the Atmospheric Science Data Center (ASDC). Information about HDF and official documentation may be found at the HDF web site (http://www.hdfgroup.org).

1.2 PRODUCTS OVERVIEW

The National Institute of Standards and Technology Advanced Radiometer (NISTAR) instrument collects irradiance data of the Earth from three radiometer sensors and one photodiode sensor and packs them into the "AppID 82" section of the DSCOVR telemetry downlink. It also records miscellaneous engineering data and packs them into "AppID 86" of the DSCOVR telemetry downlink. These data, combined with instrument temperature data from the spacecraft packed into "AppID 37", are converted into engineering units and stored as the level 1A NISTAR data products. An additional group of engineering data is packed into "AppID Misc." The data are further processed into level 1B products. These products contain data on the solar reflected and Earth emitted radiation along the Earth-Sun line. From the DSCOVR spacecraft's unique and distance vantage point, the NISTAR instrument can collect data from nearly the entire sunlit surface of the Earth. Unlike the products from other prior and current Earth science missions, the DSCOVR NISTAR products contain data for a nearly whole disc image of the Earth at a given moment in time. NISTAR level 1A and level 1B product files contain data for an entire Julian Earth day. A Julian day is defined as the interval of time from 12:00:00.00h to 11:59:59.99h the following day UTC. In addition, the Earth radiance dataset in the level 1B product is further low-pass filtered to reduce noises. This process generates level 1B filtered products which contain Earth radiance data of a month. The level 1A and level 1B data products are stored in separate HDF file as the ASDC.

The time scale in most of the data objects described here is "DSCOVR epoch time." This is the number of seconds since 00:00:00.00 hours, 24, May 1968 UTC or Julian day number 2,440,000.5.

1.3 PURPOSE

This DFCB provides the user with a detailed description of the format and contents of the DSCOVR NISTAR instrument science data products. It contains descriptions of the irradiance, telemetry, calibration, and other ancillary data and their organization into HDF data objects. This document is the specification to which the developers of the NISTAR instrument science data processing systems will develop their systems and serves as a guide to end users who will use the data.

1.4 NAMING CONVENTION FOR THE HDF PRODUCT FILES

All of the data collected by the NISTAR instrument for a given day and all associated ancillary data shall be written to a single HDF file. The following file naming convention is followed when creating NISTAR level 1a or 1b product files. Each filename shall be of the form "*nist_ll_yyyymmdd_aapbbbs_vv.h5*", where:
nist indiciates the NISTAR instrument,
ll indicate the level of processing, 1a or 1b,
yyyy indicates the year (e.g., 2015 for the year 2015),
mm indicates the number of the month of the year when obtained (e.g., 04 for April) in UTC,
dd indicates the day of the month (e.g., 07 for the 7th day of the month),
aa indicates the noon-time latitude coordinate of the Earth-disk centroid in degrees (e.g., 37) rounded to the nearest integer,
p indicates whether the coordinate is north or south latitude (n for north, s for south),
bbb indicates the noon-time longitude of the Earth-disk centroid in degrees (e.g., 072) round to the nearest integer,
s indicates the sign of the coordinate, i.e., whether the longitude is east or west (e for east, w for west),
vv indicates the version number of the product (range 01…99). For a minor version number (decimals), the format is *vv_d*, where d represents the decimal part,
h5 indicates that this is an HDF 5 file.

The normal NISTAR products contain data for a full day. The 24-hour collection period spans a Julian day, which begins at noon UTC and ends twenty-four hours later at noon UTC of the following day. The date portion of the file name represents the UTC day in which data collection ended. The centroid values in the file name are the longitude/latitude coordinates for the centroid of the Earth disk as seen from the DSCOVR spacecraft at 00:00:00h UTC.

For example: *nist_1a_20150417_37n072w_02_1.h5*. This is a Level 1A processed NISTAR data product, which contains data from 12:00:00.00h 16 April 2015 UTC to 11:59:59.99h 17 April 2015 UTC. It contains Earth data with a noon-time centroid at 37N, 72W and is version 2.1 of the product.

The level 1B filtered product files contains data for an entire month, the naming convention is "*nist_1b_yyyymm_filtered_vv.h5*", i.e., the filename specifies the year and month of the data contained. For example, *nist_1b_201901_filtered_03.h5* contains data from 12:00:00.00h 31 December 2018 UTC to 11:59:59.99h 31 January 2019 UTC. There is no centroid information in the filename of level 1B filtered products.

2 NISTAR LEVEL 1A DATA PRODUCT

2.1 PRODUCT OVERVIEW

Each NISTAR instrument science data product consists of one full (24 hour) days' worth of data from four sensors, three calibrated active cavity radiometers and an uncalibrated photodiode channel, which is used to monitor differential degradation of the band B and band C filter transmittance on-orbit. One full day is defined as the interval of time from 12:00:00.00h UTC to

11:59:59.99h UTC the following day (i.e., “Noon” to “Noon”). Ancillary data associated with the science data include data collection time, Earth centroid coordinates (for 00:00:00h UTC), and spacecraft attitude and ephemeris. The products shall be written using the HDF 5 libraries. The data objects are grouped into 9 HDF groups: Science_data, Engineering_Data, Thermistor_Data, Miscellaneous_Data, Photodiode_Current, Radiometer_Power, Ground_Calibration, On-orbit_Calibration and Geolocation_Data .

Users should be aware that for certain datasets in L1A products, the number of significant digits does not necessarily indicate that all of the figures are meaningful. For example, the demodulated radiometer power data contains several more digits than supported by their own uncertainties. This is because the data is written into HDF files as binaries without any additional rounding. The significant digits of calibration data, including both ground and on-orbit, reflect their own uncertainties since they are loaded directly from textual files.

Table 1 – L1A Data Group Types

Group	Contents
Science_Data	Contains the raw science data from AppID82 converted into engineering units
Engineering_Data	Contains the Housekeeping data from AppID86 converted into engineering units
Thermistor_Data	Contains the Thermistor temperature data from AppID37 converted into engineering units
Miscellaneous_Data	Contains both science and engineering data from AppIDMisc, which does not appear in any of the other AppID’s
Photodiode_Current	Contains tabulations of the raw photodiode currents of the celestial object in NISTAR’s view. Separate items are created for Lunar, Earth, EarthLunar (when Earth and Moon are in view), and “other” (usually “deep space” views for calibration)
Radiometer_Power	Contains tabulations of the raw radiometer powers. The radiometer power is a direct measure of the receiver heater power from the receiver ADC. The power is phase modulated by the shutter cycles.
Ground_Calibration	Contains 6 datasets, each containing laboratory-determined calibration information for the instrument. This ground-calibration information is used to convert instrument readings into irradiances.
On-orbit_Calibration	Contains calibration data used in converting instrument readings to irradiances. One example of on-orbit calibration data is the photodiode “dark-current”, which is measured regularly over the lifetime of the mission.
Geolocation_Data	Contains tabulations of all the geolocation information from the spacecraft, lunar, and solar ephemeris to lunar and Earth sub-satellite points.

2.2 DATA VOLUMES

Below are the estimated data volumes for the NISTAR groups and data types. Note that these sizes are without compression; therefore, the actual physical storage size will vary. These sizes are also listed as the maximum possible for each dataset. If there is less available data, the sizes can be lower. Also note that the on-orbit calibration data record counts, which are updated periodically throughout the mission, are particularly estimated based on a 5-year runtime. The maximum possible size of an uncompressed level 1A HDF product file is approximately 105 MB. The actual size of a level 1A HDF5 product file is approximately 16 MB or less due to compression.

Table 2 – L1A data volumes by group and dataset

Group	Dataset	Record Size (bytes)	Number Records	Object Size (bytes)
Science_Data	ScienceData	209	86,400	18,057,600
Engineering_Data	EngineeringData	367	8,640	3,170,880
Thermistor_Data	ThermistorData	19	2,880	54,720
Miscellaneous_Data	MiscellaneousData	788	86,400	68,083,200
Photodiode_Current	EarthCurrent	16	864,000	13,824,000
	LunarCurrent	16		
	EarthLunarCurrent	16		
	OtherCurrent	16		
Radiometer_Power	ModulatedRadiometerPower	42	86,400	3,628,800
	ModulatedRadiometerPower Decimated	42	14,400	604,800
Ground_Calibration	PrimaryApertureDimensions	16	1	16
	SecondaryApertureDimensions	16	1	16
	ApertureSeparation	4	1	4
	PTCThermistorResistance	20	58	1,160
	ReceiverPowerResponsivity	28	1	28
	FilterTransmissionCurves	28	115	3,220
On-orbit_ Calibration	ServoSettlingCorrection	12	3	36
	DemodulationPhaseCorrection	12	3	36
	InstrumentPointingCorrection	80	1	80
	PhotodiodeDarkCurrent	12	100	1,200
	RadiometerDarkPower	40	21,600	864,000
	AnomalousData	12	1,800	21,600
Geolocation_Data	SpacecraftEphemeris	56	1,440	80,640
	InstrumentAttitudeMatrix	80	17,280	1,382,400
	LunarEphemeris	56	1,440	80,640
	EarthSubsatellitePoint	24	1,440	34,560
	LunarSubsatellitePoint	24	1,440	34,560
	NISTARView	9	17,280	155,520
	SolarEphemeris	56	1,440	80,640

	EarthCentroidCoord	24	8640	207,360
	LunarCentroidCoord	24	8640	207,360
Attributes (embedded in each dataset)	ScienceDataAttr	3,697	1	3,697
	EngineeringDataAttr	4,910	1	4,910
	ThermistorDataAttr	275	1	275
	MiscellaneousDataAttr	7913	1	7913
	PhotodiodeCurrentAttr	98	Up to 4	392
	ModulatedRadiometerPower Attr	559	1	559
	ModulatedRadiometerPower DecimatedAttr	559	1	559
	PrimaryApertureDimensionsAttr	205	1	205
	SecondaryApertureDimensions Attr	205	1	205
	ApertureSeparationAttr	116	1	116
	PTCThermistorResistanceAttr	243	1	243
	ReceiverPowerResponsivityAttr	377	1	377
	FilterBTransmissionCurvesAttr	185	1	185
	FilterCTransmissionCurvesAttr	184	1	184
	ServoSettlingErrorCorrectionAttr	216	1	216
	DemodulationPhaseCorrection Attr	220	1	220
	InstrumentPointingCorrectionAttr	299	1	299
	PhotodiodeDarkCurrentAttr	154	1	154
	RadiometerDarkPowerAttr	274	1	274
	AnomalousDataAttr	162	1	162
	SpacecraftEphemerisAttr	240	1	240
	InstrumentAttitudeMatrixAttr	300	1	300
	LunarEphemerisAttr	235	1	235
	EarthSubsatellitePointAttr	238	1	238
	LunarSubsatellitePointAttr	238	1	238
	NISTARViewAttr	255	1	255
	SolarEphemerisAttr	237	1	237
	EarthCentroidCoordAttr	164	1	164
	LunarCentroidCoordAttr	164	1	164
Metadata	Metadata Attr	505	1	505
Approximate Total Size				110,602,797

2.3 SCIENCE DATA

The irradiances collected by the radiometers and photodiode sensors are extracted by the data processing system from AppID 82 of the telemetry received from the DSCOVR spacecraft. Each data element is directly associated with a data item in AppID 82 of the raw telemetry identified by a mnemonic. The data in the level 1A products have been converted to engineering units but retain their one-to-one associations with the items in the raw telemetry from which they were

derived. Each section of data includes at its beginning the data items from mnemonics H05TIME and H052CNT. Each record in these datasets represents the data collected in one second of instrument time.

Table 3 – Science_Data data contents

Field Name	Data Type	Order	Units	Range	Description
H052TIME	float64	1	Seconds	0…5.0E9	DSCOVR Epoch Time
ITOSQUALITY	char8	1	N/A	‘ ’ or ‘Q’	Data quality factor computed by ITOS. ASCII numerical equivalent of ‘ ’ = good, ‘Q’ = bad.
H052CNT	uint16	1	N/A	0… 16383	Packet Sequence Control Source Sequence Count
NIMJRFRMCNT	uint32	1	N/A	0… 2^{32}-1	Major Frame Count (Time Reference)
NIERRCNT	uint8	1	N/A	0…255	Command Reject Count
NICMDCNT	uint8	1	N/A	0…255	Command Accept Count
NIPDFLTRTYPE	uint8	1	N/A	0…2	Si photodiode Filter Type
NIRC3FLTRTYPE	uint8	1	N/A	0…2	Receiver Cavity 3 Filter Type
NIRC2FLTRTYPE	uint8	1	N/A	0…2	Receiver Cavity 2 Filter Type
NIRC1FLTRTYPE	uint8	1	N/A	0…2	Receiver Cavity 1 Filter Type
NIAUTOSAFE	uint8	1	N/A	0…1	Auto Safe Condition
NIMODECMD	uint8	1	N/A	0…1	Arm Mode
NIAUTOCYCLE	uint8	1	N/A	0…1	Is autocycling on
NIINSTMODE	uint8	1	N/A	0…1	Instrument Mode
NIRC1HTRBIT	uint8	1	N/A	0…1	Receiver Cavity 1 Heater Built In Test
NIRC2HTRBIT	uint8	1	N/A	0…1	Receiver Cavity 2 Heater Built in Test
NIRC3HTRBIT	uint8	1	N/A	0…1	Receiver Cavity 3 Heater Built in Test
NIHSHTRBIT	uint8	1	N/A	0…1	Heat Sink Heater Built In Test
NIPDBIT	uint8	1	N/A	0…1	Si Photodiode Build In Test
NIQHSSHKBIT	uint8	1	N/A	0…1	QHSS Housekeeping Built In Test
NIQHSSSCIBIT	uint8	1	N/A	0…1	QHSS Science Built In Test
NIQHSSMTRBIT	uint8	1	N/A	0…1	QHSS Motor Built In Test

NITSCBIT	uint8	1	N/A	0…1	DSCOVR Spacecraft Computer Built In Test
NIFWBIT	uint8	1	N/A	0…1	Filter Wheel Built In Test
NIPDSHTRBIT	uint8	1	N/A	0…1	Shutter Speed Built In Test
NIRC3SHTRBIT	uint8	1	N/A	0…1	Receiver Cavity 3 Shutter Built In Test
NIRC2SHTRBIT	uint8	1	N/A	0…1	Receiver Cavity 2 Shutter Built In Test
NIRC1SHTRBIT	uint8	1	N/A	0…1	Receiver Cavity 1 Shutter Built In Test
NI1553BIT	uint8	1	N/A	0…1	1553 Built In Test
NIOSBIT	uint8	1	N/A	0…1	Operating System Built In Test
NIPREFWPOSNUM	uint16	1	N/A	0..1104	Predicted Filter Wheel Position Number
NIRC1PRESHPOSNUM	uint8	1	N/A	0…201	Receiver Cavity 1 Predicted Shutter Position Number
NIRC2PRESHPOSNUM	uint8	1	N/A	0...201	Receiver Cavity 2 Predicted Shutter Position Number
NIRC3PRESHPOSNUM	uint8	1	N/A	0…201	Receiver Cavity 3 Predicted Shutter Position Number
NIPDPRESHPOSNUM	uint8	1	N/A	0…201	Si Photodiode Predicted Shutter Position Number
NIINSTTIME1	uint16	1	N/A	0…65535	NISTAR Instrument time 1
NIINSTTIME2	uint16	1	N/A	0…65535	NISTAR Instrument time 2
NIRC1HDACCMDAVG	float32	1	Watts	0… 6.60E-5	Receiver Cavity 1 Heater DAC Command Average
NIRC1HADCMFLAVG	float32	1	Watts	0… 6.60E-5	Receiver Cavity 1 Heater ADC Measure Filter Average
NIRC1PTCMRESAVG	float32	1	Ohms	0…23685	Receiver Cavity 1 PTC Measured Resistance Average
NIRC1CURRCALTIC	uint8	1	N/A	0…15	Receiver Cavity 1 Current Cal Tick
NIRC1DIFFMODE	uint8	1	N/A	0…4	Receiver Cavity 1 Differential Control Mode
NIRC1ADCCALST	uint8	1	N/A	0…1	Receiver Cavity 1 ADC Calibration Status

NIRC1HTRCALST	uint8	1	N/A	0…1	Receiver Cavity 1 Heater Calibration Status
NIRC1PTCCALST	uint8	1	N/A	0…1	Receiver Cavity 1 Positive Temp coefficient calibration status
NIRC1PRECHRGMOD	uint8	1	N/A	0…2	Receiver cavity 1 precharge mode
NIRC1PTCBRGNLST	uint8	1	N/A	0…1	Receiver cavity 1 PTC bridge nulled status
NIRC1PTCINSATST	uint8	1	N/A	0…1	Receiver cavity 1 PTC in saturated status
NIRC1TEMPCTRL	uint8	1	N/A	0…1	Receiver cavity 1 close loop control status
NIRC2HDACCMDAVG	float32	1	Watts	0… 6.60E-5	Receiver cavity 2 heater DAC command average
NIRC2HADCMFLAVG	float32	1	Watts	0… 6.60E-5	Receiver Cavity 2 Heater ADC Measure Filter Average
NIRC2PTCMRESAVG	float32	1	Ohms	0…23685	Receiver Cavity 2 PTC Measured Resistance Average
NIRC2CURRCALTIC	uint8	1	N/A	0…15	Receiver Cavity 2 Current Cal Tick
NIRC2DIFFMODE	uint8	1	N/A	0…4	Receiver Cavity 2 Differential Control Mode
NIRC2ADCCALST	uint8	1	N/A	0…1	Receiver Cavity 2 ADC Calibration Status
NIRC2HTRCALST	uint8	1	N/A	0…1	Receiver Cavity 2 Heater Calibration Status
NIRC2PTCCALST	uint8	1	N/A	0…1	Receiver Cavity 2 Positive Temp coefficient calibration status
NIRC2PRECHRGMOD	uint8	1	N/A	0…2	Receiver cavity 2 precharge mode
NIRC2PTCBRGNLST	uint8	1	N/A	0…1	Receiver cavity 2 PTC bridge nulled status
NIRC2PTCINSATST	uint8	1	N/A	0…1	Receiver cavity 2 PTC in saturated status
NIRC2TEMPCTRL	uint8	1	N/A	0…1	Receiver cavity 2 close loop control status
NIRC3HDACCMDAVG	float32	1	Watts	0… 6.60E-5	Receiver cavity 3 heater DAC command average
NIRC3HADCMFLAVG	float32	1	Watts	0… 6.60E-5	Receiver Cavity 3 Heater ADC Measure Filter

					Average
NIRC3PTCMRESAVG	float32	1	Ohms	0…23685	Receiver Cavity 3 PTC Measured Resistance Average
NIRC3CURRCALTIC	uint8	1	N/A	0…15	Receiver Cavity 3 Current Cal Tick
NIRC3DIFFMODE	uint8	1	N/A	0…4	Receiver Cavity 3 Differential Control Mode
NIRC3ADCCALST	uint8	1	N/A	0…1	Receiver Cavity 3 ADC Calibration Status
NIRC3HTRCALST	uint8	1	N/A	0…1	Receiver Cavity 3 Heater Calibration Status
NIRC3PTCCALST	uint8	1	N/A	0…1	Receiver Cavity 3 Positive Temp coefficient calibration status
NIRC3PRECHRGMOD	uint8	1	N/A	0…2	Receiver cavity 3 precharge mode
NIRC3PTCBRGNLST	uint8	1	N/A	0…1	Receiver cavity 3 PTC bridge nulled status
NIRC3PTCINSATST	uint8	1	N/A	0…1	Receiver cavity 3 PTC in saturated status
NIRC3TEMPCTRL	uint8	1	N/A	0…1	Receiver cavity 3 close loop control status
NIHSHDACCMDAVG	float32	1	Watts	0..3.50	Heat sink heater digital/analog converter command average
NIHSPTCMRESAVG	float32	1	Ohms	0…23685	Heat sink PTC measured resistance average
NIHSCURRCALTIC	uint8	1	N/A	0…15	Heat sink current calibration tick
NIHSADCCALST	uint8	1	N/A	0…1	Heat sink analog/digital converter calibration status
NIHSHTRCALST	uint8	1	N/A	0…1	Heat sink heater calibration status
NIHSPTCCALST	uint8	1	N/A	0…1	Heat sink positive temp coefficient calibration status
NIHSPTCBRGNLST	uint8	1	N/A	0…1	Heat sink PTC bridge nulled status
NIHSPTCINSATST	uint8	1	N/A	0…1	Heat sink close loop control status
NIHSTEMPCTRL	uint8	1	N/A	0…1	Heat Sink Close Loop Control Status
NIPDADCAVG10HZ1	int32	1	N/A	-2^{31}…	Si photodiode ADC

				2^{31}-1	average 10 Hz sample 1
NIPDADCAVG10HZ2	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode ADC average 10 Hz sample 2
NIPDADCAVG10HZ3	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode ADC average 10 Hz sample 3
NIPDADCAVG10HZ4	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode ADC average 10 Hz sample 4
NIPDADCAVG10HZ5	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode ADC average 10 Hz sample 5
NIPDADCAVG10HZ6	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode ADC average 10 Hz sample 6
NIPDADCAVG10HZ7	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode ADC average 10 Hz sample 7
NIPDADCAVG10HZ8	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode ADC average 10 Hz sample 8
NIPDADCAVG10HZ9	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode ADC average 10 Hz sample 9
NIPDADCAVG10HZ10	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode ADC average 10 Hz sample 10
NIPDDACAVG10HZ1	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 1
NIPDDACAVG10HZ2	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 2
NIPDDACAVG10HZ3	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 3
NIPDDACAVG10HZ4	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 4
NIPDDACAVG10HZ5	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 5
NIPDDACAVG10HZ6	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 6
NIPDDACAVG10HZ7	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 7
NIPDDACAVG10HZ8	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 8
NIPDDACAVG10HZ9	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 9
NIPDDACAVG10HZ10	int32	1	N/A	-2^{31}… 2^{31}-1	Si photodiode DAC average 10 Hz sample 10

The following attributes (5) are defined for the science data:

ScienceDataAttr = Science AppID82 data;<LF>
Fields = {Comma separated list of mnemonics};<LF>

Units = {Comma separated list of units};<LF>
Range = {Comma separated list of ranges each with format [Min…Max]};<LF>
Coordinate System = N/A;<LF>

2.4 ENGINEERING DATA

The engineering data contains status information about the NISTAR instrument. They are extracted by the data processing system from AppID 86 of the telemetry received from the DSCOVR spacecraft. Each data element is directly associated with a data item in AppID 86 of the raw telemetry identified by a mnemonic. The data in the level 1 products have been converted to engineering units but retain their one to one associations with the items in the raw telemetry from which they were derived. Each section of data includes at its beginning the data items from mnemonics H056TIME and H056CNT. Each record in these datasets represents the data collected in ten seconds of instrument time.

Table 4 – Engineering_Data data contents

Field Name	Data Type	Order	Units	Range	Description
H056TIME	float64	1	Seconds	0… 5.0E9	System time when packet was formed (DSCOVR Epoch)
ITOSQUALITY	char8	1	N/A	‘ ’ or ‘Q’	Data quality factor compiled by ITOS. ‘ ’= good, ‘Q’ = bad.
H056CNT	uint16	1	N/A	0… 16383	Packet sequence control source sequence count
NIRADHOUSTMP	float32	1	Celsius	-50… 120	Heat sink temperature
NIRC1MTRTMP	float32	1	Celsius	-50… 120	RC1 motor temperature
NIRC2MTRTMP	float32	1	Celsius	-50… 120	RC2 motor temperature
NIRC3MTRTMP	float32	1	Celsius	-50… 120	RC3 motor temperature
NIPDMTRTMP	float32	1	Celsius	-50… 120	Si photodiode motor temperature
NIFWMTRTMP	float32	1	Celsius	-50… 120	Filter wheel motor temp
NIPWA11TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 1-1 temperature
NIPWA12TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 1-2 temperature
NIPWA13TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 1-3 temperature

NIPWA14TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 1-4 temperature
NIPWA21TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 2-1 temperature
NIPWA22TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 2-2 temperature
NIPWA23TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 2-3 temperature
NIPWA24TMP	float32	1	Celsius	-50… 120	Analog printed wiring assembly 2-4 temperature
NILVPSTMP	float32	1	Celsius	-50… 120	Low voltage power supply temperature
NITLMPWATMP	float32	1	Celsius	-50… 120	Telemetry printed wiring assembly temperature
NIMTRDRPWATMP	float32	1	Celsius	-50… 120	Motor driver printed wiring assembly temperature
NIP5VDC	float32	1	Volts	0...20	+5 VDC
NIP15VDC	float32	1	Volts	0…40	+15 VDC
NIN15VDC	float32	1	Volts	-40…0	-15 VDC
NIP30VDC	float32	1	Volts	0… 100	+30 VDC
NITSKORID	uint8	1	N/A	0…15	ID number of last task to have an overrun
NITSKORCNT	uint16	1	N/A	0… 65535	Last task overrun count
NITSKMGROR	uint8	1	N/A	0…1	Task manager overrun status
NISCPDOR	uint8	1	N/A	0…1	Subsystem control SI photodiode overrun status
NIMMMDOR	uint8	1	N/A	0…1	Mission management mode overrun status
NISCSHTROR	uint8	1	N/A	0…1	Subsystem control shutter overrun status
NISCHTROR	uint8	1	N/A	0…1	Subsystem control heater overrun status
NISCFPGAOR	uint8	1	N/A	0…1	Subsystem control field programmable gate array overrun stat
NISCFWOR	uint8	1	N/A	0…1	Subsystem control filter wheel overrun status
NISCTSCOR	uint8	1	N/A	0…1	Subsystem control DSCOVR spacecraft computer overrun status

NIRC1SHTROSC	uint16	1	N/A	0… 65535	RC1 shutter open switch counter
NIRC1SHTRCSC	uint16	1	N/A	0… 65535	RC1 shutter close switch counter
NIRC2SHTROSC	uint16	1	N/A	0… 65535	RC2 shutter open switch counter
NIRC2SHTRCSC	uint16	1	N/A	0… 65553	RC2 shutter close switch counter
NIRC3SHTROSC	uint16	1	N/A	0… 65535	RC3 shutter open switch counter
NIRC3SHTRCSC	uint16	1	N/A	0… 65535	RC3 shutter close switch counter
NIPDSHTROSC	uint16	1	N/A	0… 65535	Si photodiode open switch counter
NIPDSHTRCSC	uint16	1	N/A	0… 65535	Si photodiode close switch counter
NIFWCWSC	uint16	1	N/A	0… 65535	Filter wheel clockwise switch counter
NIFWCCWSC	uint16	1	N/A	0… 65535	Filter wheel counter clockwise switch counter
NIPDBRDGNULL	uint8	1	N/A	0…1	Si photodiode bridge nulled status
NIPDINSAT	uint8	1	N/A	0…1	Si photodiode in saturation status
NIPDFZDACCMD	uint8	1	N/A	0…1	Si photodiode freeze DAC command status
NIPDPID2P	float32	1	N/A	0… 50.0	Si photodiode proportional integral derivative 2 P
NIPDPID2I	float32	1	N/A	0…50.0	Si photodiode proportional integral derivative 2 I
NIPDPID2D	float32	1	N/A	0… 50.0	Si photodiode proportional integral derivative 2 D
NIPDPID2KLP	float32	1	N/A	0… 1.0E8	Si photodiode proportional integral derivative 2K loop
NIPDCAL	uint8	1	N/A	0…9	Si photodiode shutter calibration state
NIRC3CAL	uint8	1	N/A	0…9	RC3 Shutter calibration state
NIRC2CAL	uint8	1	N/A	0…9	RC2 Shutter calibration state

NIRC1CAL	uint8	1	N/A	0…9	RC1 Shutter calibration state
NIRC1SHCYCLE	uint8	1	N/A	0…1	RC1 Shutter Cycle
NIRC2SHCYCLE	uint8	1	N/A	0…1	RC2 Shutter Cycle
NIRC3SHCYCLE	uint8	1	N/A	0…1	RC3 Shutter Cycle
NIPDSHCYCLE	uint8	1	N/A	0…1	Photodiode shutter cycle
NIFWCAL	uint8	1	N/A	0…9	Filter wheel calibration state
NIRC1PTCRSP	float32	1	Ohms	0… 23000	RC1 PTC resistance setpoint command
NIRC1PID2P	float32	1	N/A	0… 50.0	RC1 proportional integral derivative 2 P
NIRC1PID2I	float32	1	N/A	0…50.0	RC1 proportional integral derivative 2 I
NIRC1PID2D	float32	1	N/A	0… 50.0	RC1 proportional integral derivative 2 D
NIRC1PID2K	float32	1	N/A	0… 1.0E8	RC1 proportional integral derivative 2 K loop
NIRC1BNOMSF	float32	1	N/A	0…2.0	RC1 bridge null offset measurement scale factor
NIRC1MDACSF	float32	1	N/A	0…2.0	RC1 MDAC scale factor
NIRC1HTRSF	float32	1	N/A	0…2.0	RC1 heater scale factor
NIRC1DIFFMDSF	float32	1	N/A	0… 10.0	RC1 differential mode scale factor
NIRC1BNOMOFFST	float32	1	N/A	-65536… 65535	RC1 bridge null offset measurement offset
NIRC1HTROFFST	float32	1	N/A	-65536… 65535	RC1 heater offset
NIRC1MDACOFFST	float32	1	N/A	-65536… 65535	RC1 MDAC offset
NIRC1CMDOLPWR	float32	1	Watts	0… 6.60e-5	RC1 commanded open loop power
NIRC1SINWVFRQ	uint8	1	Hz	34… 156	RC1 sine wave frequency
NIRC2PTCRSP	float32	1	Ohms	0… 23000	RC2 PTC resistance setpoint command
NIRC2PID2P	float32	1	N/A	0… 50.0	RC2 proportional integral derivative 2 P
NIRC2PID2I	float32	1	N/A	0…50.0	RC2 proportional integral derivative 2 I
NIRC2PID2D	float32	1	N/A	0… 50.0	RC2 proportional integral derivative 2 D
NIRC2PID2K	float32	1	N/A	0… 1.0E8	RC2 proportional integral derivative 2 K loop

NIRC2BNOMSF	float32	1	N/A	0…2.0	RC2 bridge null offset measurement scale factor
NIRC2MDACSF	float32	1	N/A	0…2.0	RC2 MDAC scale factor
NIRC2HTRSF	float32	1	N/A	0…2.0	RC2 heater scale factor
NIRC2DIFFMDSF	float32	1	N/A	0… 10.0	RC2 differential mode scale factor
NIRC2BNOMOFFST	float32	1	N/A	-65536… 65535	RC2 bridge null offset measurement offset
NIRC2HTROFFST	float32	1	N/A	-65536… 65535	RC2 heater offset
NIRC2MDACOFFST	float32	1	N/A	-65536… 65535	RC2 MDAC offset
NIRC2CMDOLPWR	float32	1	Watts	0… 6.60e-5	RC2 commanded open loop power
NIRC2SINWVFRQ	uint8	1	Hz	34… 156	RC2 sine wave frequency
NIRC3PTCRSP	float32	1	Ohms	0… 23000	RC3 PTC resistance setpoint command
NIRC3PID2P	float32	1	N/A	0… 50.0	RC3 proportional integral derivative 2 P
NIRC3PID2I	float32	1	N/A	0…50.0	RC3 proportional integral derivative 2 I
NIRC3PID2D	float32	1	N/A	0… 50.0	RC3 proportional integral derivative 2 D
NIRC3PID2K	float32	1	N/A	0… 1.0E8	RC3 proportional integral derivative 2 K loop
NIRC3BNOMSF	float32	1	N/A	0…2.0	RC3 bridge null offset measurement scale factor
NIRC3MDACSF	float32	1	N/A	0…2.0	RC3 MDAC scale factor
NIRC3HTRSF	float32	1	N/A	0…2.0	RC3 heater scale factor
NIRC3DIFFMDSF	float32	1	N/A	0… 10.0	RC3 differential mode scale factor
NIRC3BNOMOFFST	float32	1	N/A	-65536… 65535	RC3 bridge null offset measurement offset
NIRC3HTROFFST	float32	1	N/A	-65536… 65535	RC3 heater offset
NIRC3MDACOFFST	float32	1	N/A	-65536… 65535	RC3 MDAC offset
NIRC3CMDOLPWR	float32	1	Watts	0… 6.60e-5	RC3 commanded open loop power
NIRC3SINWVFRQ	uint8	1	Hz	34… 156	RC3 sine wave frequency
NIHSPTCRSP	float32	1	Ohms	0… 23000	Heat sink PTC resistance setpoint command

NIHSPID2P	float32	1	N/A	0… 50.0	Heat sink proportional integral derivative 2 P
NIHSPID2I	float32	1	N/A	0…50.0	Heat sink proportional integral derivative 2 I
NIHSPID2D	float32	1	N/A	0… 50.0	Heat sink proportional integral derivative 2 D
NIHSPID2K	float32	1	N/A	0… 1.0E8	Heat sink proportional integral derivative 2 K loop
NIHSBNOMSF	float32	1	N/A	0…2.0	Heat sink bridge null offset measurement scale factor
NIHSMDACSF	float32	1	N/A	0…2.0	Heat sink MDAC scale factor
NIHSDIFFMDSF	float32	1	N/A	0… 10.0	Heat sink differential mode scale factor
NIHSBNOMOFFST	float32	1	N/A	0… 65535	Heat sink bridge null offset measurement offset
NIHSMDACOFFST	float32	1	N/A	0… 6553	Heat sink MDAC offset
NIHSCMDOLPWR	float32	1	Watts	0… 3.5	Heat sink Commanded open loop power
NIHSSINWVFRQ	uint8	1	Hz	34… 156	Heat sink commanded sine wave frequency
NIRC3HTRCALEN	uint8	1	N/A	0…1	RC3 heater calibration enabled
NIHSPTCCALEN	uint8	1	N/A	0…1	Heat sink PTC calibration enabled
NIRC3PTCCALEN	uint8	1	N/A	0…1	RC3 calibration enabled
NIRC2HTRCALEN	uint8	1	N/A	0…1	RC2 heater calibration enabled
NIRC1HTRCALEN	uint8	1	N/A	0…1	RC1 heater calibration enabled
NIRC2PTCCALEN	uint8	1	N/A	0…1	RC2 calibration enabled
NIRC1PTCCALEN	uint8	1	N/A	0…1	RC1 calibration enabled
NISCEXTWDT	uint8	1	N/A	0…1	External watch dog timer (science analog board)
NISCLOCWDT	uint8	1	N/A	0…1	Local watch dog timer (science analog board)

The following attributes (5) are defined for the engineering data:

EngineeringDataAttr = Engineering AppID86 data;<LF>
Fields = {Comma separated list of mnemonics};<LF>

Units = {Comma separated list of units};<LF>
Range = {Comma separated list of ranges each with format [Min…Max]};<LF>
Coordinate System = N/A;<LF>

2.5 THERMISTOR DATA

The NISTAR thermistor data contains information on the temperature of the NISTAR instrument. These data come down in AppID 37 and are stored separately from the AppID 82 and AppID 86 data. Also included are mnemonics H025CNT and H025TIME which are packet count and packet time respectively. UHNISTEMP1 is in ICE box on an aluminum block (the block also houses thermostats). UHNISTEMP2 is on the interface plate between the heat sink and the radiometer housing. Each record in these datasets represents the data collected in 30 seconds of instrument time.

Table 5 – Thermistor_Data data contents

Field Name	Data Type	Order	Units	Range	Description
H025TIME	float64	1	Seconds	0…5.0E9	System time when packet was formed (DSCOVR Epoch)
ITOSQUALITY	char8	1	N/A	‘ ’ or ‘Q’	Data quality factor compiled by ITOS. ‘ ’= good, ‘Q’ = bad.
H025CNT	uint16	1	N/A	0…16383	Packet sequence control source sequence count
UHNISTTEMP1	float32	1	Celsius	-50…120	Temperature as measured by thermistor 1
UHNISTTEMP2	float32	1	Celsius	-50…120	Temperature as measured by thermistor 2

The following attributes (5) are defined for the thermistor data:

ThermistorDataAttr = Thermistor AppID37 data;<LF>
Fields = {Comma separated list of mnemonics};<LF>
Units = {Comma separated list of units};<LF>
Range = {Comma separated list of ranges each with format [Min…Max]};<LF>
Coordinate System = N/A;<LF>

2.6 MISCELLANEOUS DATA

A new AppID was generated to help diagnose instrument performance on the ground, called AppID Misc. This included both science and engineering data which did not appear in any of the other AppID’s. Each data element is directly associated with a data item in AppIDMisc of the raw telemetry identified by a mnemonic. The data in the level 1 products have been converted to engineering units, but retain their one to one associations with the items in the raw telemetry from which they were derived.

Table 6 – Miscellaneous_Data data contents

Field Name	Data Type	Order	Units	Range	Description
H052TIME	float64	1	Seconds	0...5.0E9	Dscovr Epoch Time
NIRC1BNOMMESAVG	int32	1	N/A	$-2^{31}...2^{31}-1$	RC1 BNOM Measured Average
NIRC1PREDITMDAC	int32	1	N/A	0...65535	RC1 Pre Dither MDAC Command
NIRC1PTCRERRAVG	int32	1	Ohms	$-2^{31}...2^{31}-1$	RC1 PTC Resistance Error Average
NIRC1FZMDACCMD	int32	1	N/A	0...1	RC1 Freeze MDAC Command
NIRC2BNOMMESAVG	int32	1	N/A	$-2^{31}...2^{31}-1$	RC2 BNOM Measured Average
NIRC2PREDITMDAC	int32	1	N/A	0...65535	RC2 Pre Dither MDAC Command
NIRC2PTCRERRAVG	int32	1	Ohms	$-2^{31}...2^{31}-1$	RC2 PTC Resistance Error Average
NIRC2FZMDACCMD	int32	1	N/A	0...1	RC2 Freeze MDAC Command
NIRC3BNOMMESAVG	int32	1	N/A	$-2^{31}...2^{31}-1$	RC3 BNOM Measured Average
NIRC3PREDITMDAC	int32	1	N/A	0...65535	RC3 Pre Dither MDAC Command
NIRC3PTCRERRAVG	int32	1	Ohms	$-2^{31}...2^{31}-1$	RC3 PTC Resistance Error Average
NIRC3FZMDACCMD	int32	1	N/A	0...1	RC3 Freeze MDAC Command
NIHSBNOMMESAVG	int32	1	N/A	$-2^{31}...2^{31}-1$	HS BNOM Measured Average
NIHSPREDITMDAC	int32	1	N/A	0...65535	HS Pre Dither MDAC Command
NIHSPTCRERRAVG	int32	1	Ohms	$-2^{31}...2^{31}-1$	HS PTC Resistance Error Average
NIHSFZMDACCMD	int32	1	N/A	0…1	HS Freeze MDAC Command
NILASTCMD	int32	1	N/A	0...65535	Last Command
NILASTCMDFLD	int32	1	N/A	0...65535	Last Command Field
NIPDCMDRC1LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC1 Load Phase Status
NIPDCMDRC1MTREN	int32	1	N/A	0…1	PD Motor Control Command RC1 Motor Enabled

					Status
NIRC2CMDRC1LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC2 Load Phase Status
NIRC2CMDRC1MTREN	int32	1	N/A	0…1	PD Motor Control Command RC2 Motor Enabled Status
NIRC3CMDRC1LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC3 Load Phase Status
NIRC3CMDRC1MTREN	int32	1	N/A	0…1	PD Motor Control Command RC3 Motor Enabled Status
NIRC1CMDFWLDPHS	int32	1	N/A	0…1	RC1 Motor Control Command FW Load Phase Status
NIRC1CMDFWMTREN	int32	1	N/A	0…1	RC1 Motor Control Command FW Motor Enabled Status
NIRC1CMDLDSTPCTR	int32	1	N/A	0…1	RC1 Motor Control Command Load Step Counter Status
NIRC1CMDMTRCTRRS	int32	1	N/A	0…1	RC1 Motor Control Command Motor Counter Reset Status
NIRC1CMDMTRDIR	int32	1	N/A	0…1	RC1 Motor Control Command Motor Direction
NIRC1CMDMTRHLDOF	int32	1	N/A	0...65535	RC1 Motor Control Command Motor Hold Off
NIRC1CMDMTRPHSA	int32	1	N/A	0…1	RC1 Motor Control Command Motor Phase A Status
NIRC1CMDMTRPHSB	int32	1	N/A	0…1	RC1 Motor Control Command Motor Phase B Status
NIRC1CMDMTRSPD	int32	1	N/A	0...7	RC1 Motor Control Command Motor Speed
NIRC1CMDMTRSTOP	int32	1	N/A	0…1	RC1 Motor Control Command Stop

					Motor Status
NIRC1CMDMTRSTPCT	int32	1	N/A	0...65535	RC1 Motor Control Command Motor Step Count
NIRC1CMDSTPCLKEN	int32	1	N/A	0…1	RC1 Motor Control Command Step Clock Enable Status
NIRC1MTRGOCMD	int32	1	N/A	0…1	RC1 Motor Go Command
NIPDCMDRC2LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC2 Load Phase Status
NIPDCMDRC2MTREN	int32	1	N/A	0…1	PD Motor Control Command RC2 Motor Enabled Status
NIRC1CMDRC2LDPHS	int32	1	N/A	0…1	RC1 Motor Control Command RC2 Load Phase Status
NIRC1CMDRC2MTREN	int32	1	N/A	0…1	RC1 Motor Control Command RC2 Motor Enabled Status
NIRC3CMDRC2LDPHS	int32	1	N/A	0…1	RC3 Motor Control Command RC2 Load Phase Status
NIRC3CMDRC2MTREN	int32	1	N/A	0…1	RC3 Motor Control Command RC2 Motor Enabled Status
NIRC2CMDFWLDPHS	int32	1	N/A	0…1	RC2 Motor Control Command FW Load Phase Status
NIRC2CMDFWMTREN	int32	1	N/A	0…1	RC2 Motor Control Command FW Motor Enabled Status
NIRC2CMDLDSTPCTR	int32	1	N/A	0…1	RC2 Motor Control Command Load Step Counter Status
NIRC2CMDMTRCTRRS	int32	1	N/A	0…1	RC2 Motor Control Command Motor Counter Reset Status
NIRC2CMDMTRDIR	int32	1	N/A	0…1	RC2 Motor Control Command Motor

					Direction
NIRC2CMDMTRHLDOF	int32	1	N/A	0...65535	RC2 Motor Control Command Motor Hold Off
NIRC2CMDMTRPHSA	int32	1	N/A	0…1	RC2 Motor Control Command Motor Phase A Status
NIRC2CMDMTRPHSB	int32	1	N/A	0…1	RC2 Motor Control Command Motor Phase B Status
NIRC2CMDMTRSPD	int32	1	N/A	0...7	RC2 Motor Control Command Motor Speed
NIRC2CMDMTRSTOP	int32	1	N/A	0…1	RC2 Motor Control Command Stop Motor Status
NIRC2CMDMTRSTPCT	int32	1	N/A	0...65535	RC2 Motor Control Command Motor Step Count
NIRC2CMDSTPCLKEN	int32	1	N/A	0…1	RC2 Motor Control Command Step Clock Enable Status
NIRC2MTRGOCMD	int32	1	N/A	0…1	RC2 Motor Go Command
NIPDCMDRC3LDPHS	int32	1	N/A	0…1	PD Motor Control Command RC3 Load Phase Status
NIPDCMDRC3MTREN	int32	1	N/A	0…1	PD Motor Control Command RC3 Motor Enabled Status
NIRC1CMDRC3LDPHS	int32	1	N/A	0…1	RC1 Motor Control Command RC3 Load Phase Status
NIRC1CMDRC3MTREN	int32	1	N/A	0…1	RC1 Motor Control Command RC3 Motor Enabled Status
NIRC2CMDRC3LDPHS	int32	1	N/A	0…1	RC2 Motor Control Command RC3 Load Phase Status
NIRC2CMDRC3MTREN	int32	1	N/A	0…1	RC2 Motor Control Command RC3 Motor Enabled Status

NIRC3CMDFWLDPHS	int32	1	N/A	0…1	RC3 Motor Control Command FW Load Phase Status
NIRC3CMDFWMTREN	int32	1	N/A	0…1	RC3 Motor Control Command FW Motor Enabled Status
NIRC3CMDLDSTPCTR	int32	1	N/A	0…1	RC3 Motor Control Command Load Step Counter Status
NIRC3CMDMTRCTRRS	int32	1	N/A	0…1	RC3 Motor Control Command Motor Counter Reset Status
NIRC3CMDMTRDIR	int32	1	N/A	0…1	RC3 Motor Control Command Motor Direction
NIRC3CMDMTRHLDOF	int32	1	N/A	0...65535	RC3 Motor Control Command Motor Hold Off
NIRC3CMDMTRPHSA	int32	1	N/A	0…1	RC3 Motor Control Command Motor Phase A Status
NIRC3CMDMTRPHSB	int32	1	N/A	0…1	RC3 Motor Control Command Motor Phase B Status
NIRC3CMDMTRSPD	int32	1	N/A	0...7	RC3 Motor Control Command Motor Speed
NIRC3CMDMTRSTOP	int32	1	N/A	0…1	RC3 Motor Control Command Stop Motor Status
NIRC3CMDMTRSTPCT	int32	1	N/A	0...65535	RC3 Motor Control Command Motor Step Count
NIRC3CMDSTPCLKEN	int32	1	N/A	0…1	RC3 Motor Control Command Step Clock Enable Status
NIRC3MTRGOCMD	int32	1	N/A	0…1	RC3 Motor Go Command
NIRC1CMDPDLDPHS	int32	1	N/A	0…1	RC1 Motor Control Command PD Load Phase Status
NIRC1CMDPDMTREN	int32	1	N/A	0…1	RC1 Motor Control Command PD Motor Enabled Status

NIRC2CMDPDLDPHS	int32	1	N/A	0…1	RC2 Motor Control Command PD Load Phase Status
NIRC2CMDPDMTREN	int32	1	N/A	0…1	RC2 Motor Control Command PD Motor Enabled Status
NIRC3CMDPDLDPHS	int32	1	N/A	0…1	RC3 Motor Control Command PD Load Phase Status
NIRC3CMDPDMTREN	int32	1	N/A	0…1	RC3 Motor Control Command PD Motor Enabled Status
NIPDCMDFWLDPHS	int32	1	N/A	0…1	PD Motor Control Command FW Load Phase Status
NIPDCMDFWMTREN	int32	1	N/A	0…1	PD Motor Control Command FW Motor Enabled Status
NIPDCMDLDSTPCTR	int32	1	N/A	0…1	PD Motor Control Command Load Step Counter Status
NIPDCMDMTRCTRRS	int32	1	N/A	0…1	PD Motor Control Command Motor Counter Reset Status
NIPDCMDMTRDIR	int32	1	N/A	0…1	PD Motor Control Command Motor Direction
NIPDCMDMTRHLDOFF	int32	1	N/A	0...65535	PD Motor Control Command Motor Hold Off
NIPDCMDMTRPHSA	int32	1	N/A	0…1	PD Motor Control Command Motor Phase A Status
NIPDCMDMTRPHSB	int32	1	N/A	0…1	PD Motor Control Command Motor Phase B Status
NIPDCMDMTRSPD	int32	1	N/A	0...7	PD Motor Control Command Motor Speed
NIPDCMDMTRSTOP	int32	1	N/A	0…1	PD Motor Control Command Stop Motor Status
NIPDCMDMTRSTPCNT	int32	1	N/A	0...65535	PD Motor Control Command Motor

					Step Count
NIPDCMDSTPCLCKEN	int32	1	N/A	0…1	PD Motor Control Command Step Clock Enable Status
NIPDMTRGOCMD	int32	1	N/A	0…1	PD Motor Go Command
NIRC1POSCLSD	int32	1	N/A	0…1	RC1 Position Closed
NIRC1POSOPN	int32	1	N/A	0…1	RC1 Position Open
NIRC2POSCLSD	int32	1	N/A	0…1	RC2 Position Closed
NIRC2POSOPN	int32	1	N/A	0…1	RC2 Position Open
NIRC3POSCLSD	int32	1	N/A	0…1	RC3 Position Closed
NIRC3POSOPN	int32	1	N/A	0…1	RC3 Position Open
H056TIME	float64	1	Seconds	0...5.0E9	System time when packed was formed (DSCOVR epoch)
NIRC1PHAMTRI	int32	1	milliAmps	-50...175	RC1 Phase A Motor Current
NIRC1PHBMTRI	int32	1	milliAmps	-50...175	RC1 Phase B Motor Current
NIRC2PHAMTRI	int32	1	milliAmps	-50...175	RC2 Phase A Motor Current
NIRC2PHBMTRI	int32	1	milliAmps	-50...175	RC2 Phase B Motor Current
NIRC3PHAMTRI	int32	1	milliAmps	-50...175	RC3 Phase A Motor Current
NIRC3PHBMTRI	int32	1	milliAmps	-50...175	RC3 Phase B Motor Current
NIPDPHAMTRI	int32	1	milliAmps	-50...175	PD Phase A Motor Current
NIPDPHBMTRI	int32	1	milliAmps	-50...175	PD Phase B Motor Current
NIFWPHAMTRI	int32	1	milliAmps	-50...175	FW Phase A Motor Current
NIFWPHBMTRI	int32	1	milliAmps	-50...175	FW Phase B Motor Current
NIRC1PHAMTRIPV	int32	1	milliAmps	-50...175	Peak RC1 Phase A Motor Current
NIRC1PHBMTRIPV	int32	1	milliAmps	-50...175	Peak RC1 Phase B Motor Current
NIRC2PHAMTRIPV	int32	1	milliAmps	-50...175	Peak RC2 Phase A Motor Current
NIRC2PHBMTRIPV	int32	1	milliAmps	-50...175	Peak RC2 Phase B Motor Current
NIRC3PHAMTRIPV	int32	1	milliAmps	-50...175	Peak RC3 Phase A

					Motor Current
NIRC3PHBMTRIPV	int32	1	milliAmps	-50...175	Peak RC3 Phase B Motor Current
NIPDPHAMTRIPV	int32	1	milliAmps	-50...175	Peak PD Phase A Motor Current
NIPDPHBMTRIPV	int32	1	milliAmps	-50...175	Peak PD Phase B Motor Current
NIFWPHAMTRIPV	int32	1	milliAmps	-50...175	Peak FW Phase A Motor Current
NIFWPHBMTRIPV	int32	1	milliAmps	-50...175	Peak FW Phase B Motor Current
NIRADHOUSTMPPV	int32	1	Celsius	-50...120	Peak Heat Sink Temperature
NIRC1MTRTMPPV	int32	1	Celsius	-50...120	Peak RC1 Motor Temperature
NIRC2MTRTMPPV	int32	1	Celsius	-50...120	Peak RC2 Motor Temperature
NIRC3MTRTMPPV	int32	1	Celsius	-50...120	Peak RC3 Motor Temperature
NIPDMTRTMPPV	int32	1	Celsius	-50...120	Peak PD Motor Temperature
NIFWMTRTMPPV	int32	1	Celsius	-50...120	Peak FW Motor Temperature
NIPWA11TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 1-1 Temperature
NIPWA12TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 1-2 Temperature
NIPWA13TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 1-3 Temperature
NIPWA14TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 1-4 Temperature
NIPWA21TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 2-1 Temperature
NIPWA22TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 2-2 Temperature
NIPWA23TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 2-3 Temperature
NIPWA24TMPPV	int32	1	Celsius	-50...120	Peak Wire Assembly 2-4 Temperature
NILVPSTMPPV	int32	1	Celsius	-50...120	Peak Low Voltage Power Supply Temp
NITLMPWATMPPV	int32	1	Celsius	-50...120	Peak Telemetry Wire Assembly Temp

NIMTRDRPWATMPPV	int32	1	Celsius	-50...120	Peak Motor Driver Wire Assembly Temp
NIP5VDCPV	int32	1	Volts	0...20	Peak +5 VDC
NIP15VDCPV	int32	1	Volts	0...40	Peak +15 VDC
NIN15VDCPV	int32	1	Volts	-40...0	Peak -15 VDC
NIP30VDCPV	int32	1	Volts	0...100	Peak +30 VDC
NIRC1AREA	int32	1	Percent	0...100	RC1 Area
NIRC2AREA	int32	1	Percent	0...100	RC2 Area
NIRC3AREA	int32	1	Percent	0...100	RC3 Area
NIPDAREA	int32	1	Percent	0...100	SiPD Area
NISPARE1	float32	1	N/A	$0...2^{32}-1$	NISTAR Spare 1
NISPARE2	float32	1	N/A	$0...2^{32}-1$	NISTAR Spare 2
NISPARE3	float32	1	N/A	$0...2^{32}-1$	NISTAR Spare 3
NISPARE4	float32	1	N/A	$0...2^{32}-1$	NISTAR Spare 4
NISPARE5	float32	1	N/A	$0...2^{32}-1$	NISTAR Spare 5
NISPARE6	float32	1	N/A	$0...2^{32}-1$	NISTAR Spare 6
NIRC1FCPRECHRGA	float32	1	N/A	$0...2^{32}-1$	RC1 Fixed Close Precharge Type A Filter
NIRC1FCPRECHRGB	float32	1	N/A	$0...2^{32}-1$	RC1 Fixed Close Precharge Type B Filter
NIRC1FCPRECHRGC	float32	1	N/A	$0...2^{32}-1$	RC1 Fixed Close Precharge Type C Filter
NIRC2FCPRECHRGA	float32	1	N/A	$0...2^{32}-1$	RC2 Fixed Close Precharge Type A Filter
NIRC2FCPRECHRGB	float32	1	N/A	$0...2^{32}-1$	RC2 Fixed Close Precharge Type B Filter
NIRC2FCPRECHRGC	float32	1	N/A	$0...2^{32}-1$	RC2 Fixed Close Precharge Type C Filter
NIRC3FCPRECHRGA	float32	1	N/A	$0...2^{32}-1$	RC3 Fixed Close Precharge Type A Filter
NIRC3FCPRECHRGB	float32	1	N/A	$0...2^{32}-1$	RC3 Fixed Close Precharge Type B Filter
NIRC3FCPRECHRGC	float32	1	N/A	$0...2^{32}-1$	RC3 Fixed Close Precharge Type C Filter

NIRC1FOPRECHRGA	float32	1	N/A	0...2^{32}-1	RC1 Fixed Open Precharge Type A Filter
NIRC1FOPRECHRGB	float32	1	N/A	0...2^{32}-1	RC1 Fixed Open Precharge Type B Filter
NIRC1FOPRECHRGC	float32	1	N/A	0...2^{32}-1	RC1 Fixed Open Precharge Type C Filter
NIRC2FOPRECHRGA	float32	1	N/A	0...2^{32}-1	RC2 Fixed Open Precharge Type A Filter
NIRC2FOPRECHRGB	float32	1	N/A	0...2^{32}-1	RC2 Fixed Open Precharge Type B Filter
NIRC2FOPRECHRGC	float32	1	N/A	0...2^{32}-1	RC2 Fixed Open Precharge Type C Filter
NIRC3FOPRECHRGA	float32	1	N/A	0...2^{32}-1	RC3 Fixed Open Precharge Type A Filter
NIRC3FOPRECHRGB	float32	1	N/A	0...2^{32}-1	RC3 Fixed Open Precharge Type B Filter
NIRC3FOPRECHRGC	float32	1	N/A	0...2^{32}-1	RC3 Fixed Open Precharge Type C Filter
NIRC1AOPRECHRG0	float32	1	N/A	0...2^{32}-1	RC1 Auto Open Precharge Type A Filter
NIRC1AOPRECHRG1	float32	1	N/A	0...2^{32}-1	RC1 Auto Open Precharge Type B Filter
NIRC1ACPRECHRG0	float32	1	N/A	0...2^{32}-1	RC1 Auto Close Precharge Type A Filter
NIRC1ACPRECHRG1	float32	1	N/A	0...2^{32}-1	RC1 Auto Close Precharge Type B Filter
NIRC2AOPRECHRG0	float32	1	N/A	0...2^{32}-1	RC2 Auto Open Precharge Type A Filter
NIRC2AOPRECHRG1	float32	1	N/A	0...2^{32}-1	RC2 Auto Open Precharge Type B Filter

NIRC2ACPRECHRG0	float32	1	N/A	0...2^{32}-1	RC2 Auto Close Precharge Type A Filter
NIRC2ACPRECHRG1	float32	1	N/A	0...2^{32}-1	RC2 Auto Close Precharge Type B Filter
NIRC3AOPRECHRG0	float32	1	N/A	0...2^{32}-1	RC3 Auto Open Precharge Type A Filter
NIRC3AOPRECHRG1	float32	1	N/A	0...2^{32}-1	RC3 Auto Open Precharge Type B Filter
NIRC3ACPRECHRG0	float32	1	N/A	0...2^{32}-1	RC3 Auto Close Precharge Type A Filter
NIRC3ACPRECHRG1	float32	1	N/A	0...2^{32}-1	RC3 Auto Close Precharge Type B Filter
NISCRC1PTCBSY	int32	1	N/A	0...1	RC1 PTC Busy (Science Analog Board)
NISCRC2PTCBSY	int32	1	N/A	0...1	RC2 PTC Busy (Science Analog Board)
NISCRC3PTCBSY	int32	1	N/A	0...1	RC3 PTC Busy (Science Analog Board)
NISCHSPTCBSY	int32	1	N/A	0...1	HS PTC Busy (Science Analog Board)
NIRC1BNOMRW	int32	1	N/A	0...65535	RC1 Bridge Null Offset Measurement Raw
NIRC2BNOMRW	int32	1	N/A	0...65535	RC2 Bridge Null Offset Measurement Raw
NIRC3BNOMRW	int32	1	N/A	0...65535	RC3 Bridge Null Offset Measurement Raw
NIRC1MDACCMD	int32	1	N/A	0...65535	RC1 MDAC Command
NIRC2MDACCMD	int32	1	N/A	0...65535	RC2 MDAC Command
NIRC3MDACCMD	int32	1	N/A	0...65535	RC3 MDAC Command

PNNISTARCUR	int32	1	Amps	-3...3.5	NISTAR Instrument Current
NIPDBRDGNULL	int32	1	N/A	0...1	PD Bridge Nulled Status
NIHSBNOMRW	int32	1	N/A	0...65535	HS Bridge Null Offset Measurement Raw

The following attributes (5) are defined for the Miscellaneous_data:

MiscellaneousDataAttr = Miscellaneous AppIDMisc data;<LF>
Fields = {Comma separated list of mnemonics};<LF>
Units = {Comma separated list of units};<LF>
Range = {Comma separated list of ranges each with format [Min…Max]};<LF>
Coordinate System = N/A;<LF>

2.7 PHOTODIODE CURRENT DATA

These values are the Earth or Moon's current values as measured by the NISTAR instrument's photodiode sensor. The NISTAR instrument can view either the Earth or the Moon alone or both together. It may also view bright planets. The epoch times are expressed in the number of seconds since 24 May 1968, 00:00:00.00h UTC accurate to 0.01 seconds. Lunar irradiances and centroid coordinates are included only in products that contain lunar data. The irradiance and centroid data are scaled to NISTAR epoch time using HDF dimension scaling. The NISTAR instrument has a 7 degree acceptance angle. This wide field will result in collection of irradiance from both the Earth and the Moon together about 15% of the time. Modeled Lunar irradiances may not be included at all times. Centroid coordinates are not included with data of objects other that the Earth or Moon.

Table 7 - Photodiode_Current group contents

Dataset	**Data type**	**Description**
EarthCurrent	Dataset	Contains the Earth currents
LunarCurrent	Dataset	Contains the Lunar currents
EarthLunarCurrent	Dataset	Contains the currents of the Earth and Moon together
OtherCurrent	Dataset	Contains other currents

2.7.1 Earth Current

These data sets contain the Earth current as measured by the photodiode at 0.1 second samplings. This is produced when only the Earth is in the field of regard.

Table 8 - Earth Current data contents

Dataset	**Data type**	**Order**	**Units**	**Range**	**Description**

Epoch Time	float64	864,000	Seconds	0… 5E9	DSCOVR epoch time
Current	float64	864,000	Amps	0… 1E-5	Earth current values at 0.1 second sampling intervals in amperes as measured by the photodiode. Produced when only the Earth is in the field of regard.

The following attributes (5) are defined for the Earth photodiode current data:

EarthCurrent_Attr = Photodiode current data; <LF>
Fields = Epoch Time, Photodiode Current; <LF>
Units = Seconds, Amps; <LF>
Range = [0.0...5.0E9], [0.0...1.0E-5]; <LF>
Coordinate System = N/A;<LF>

2.7.2 Lunar Current

These data sets contain the lunar and modeled lunar current as measured by the photodiode at 0.1 second samplings. This is produced when only the moon is in the field of regard.

Table 9 - Lunar Current data contents

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	864,000	Seconds	0… 5E9	DSCOVR epoch time
Current	float64	864,000	Amps	0… 1E-5	Lunar current values at 0.1 second sampling intervals in amperes as measured by the photodiode. Produced when only the Moon is in the field of regard.

The following attributes (5) are defined for the lunar photodiode current data:

LunarCurrent_Attr = Photodiode current data; <LF>
Fields = Epoch Time, Photodiode Current; <LF>
Units = Seconds, Amps; <LF>
Range = [0.0...5.0E9], [0.0...1.0E-5]; <LF>
Coordinate System = N/A;<LF>

2.7.3 Earth/Lunar Current

This data set contains the combined Earth and Lunar current values as measured by the photodiode. This is produced when both bodies are in the field of regard.

Table 10 - Earth/Lunar Current data contents

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	864,000	Seconds	0… 5E9	DSCOVR epoch time
Current	float64	864,000	Amps	0… 1E-5	Combined Earth and Lunar current values at 0.1 second sampling interval in amperes as measured by the photodiode. Produced when both bodies appear in the field of regard.

The following attributes (5) are defined for the Earth/lunar photodiode current data:

EarthMoonCurrent_Attr = Photodiode current data; <LF>
Fields = Epoch Time, Photodiode Current; <LF>
Units = Seconds, Amps; <LF>
Range = [0.0...5.0E9], [0.0...1.0E-5]; <LF>
Coordinate System = N/A;<LF>

2.7.4 Other Object Current

This data set contains the current of objects other than the Earth or the Moon, such as deep space or bright planets, as measured by the photodiode at 0.1 second samplings. This data set will not be included in products that do not contain data from such objects.

Table 11 - Other current data contents

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	864,000	Seconds	0… 5E9	DSCOVR epoch time
Current	float64	864,000	Amps	0… 1E-5	Other Object current values at 0.1 second sampling intervals in amperes as measured by the photodiode. Produced when neither Earth nor Moon is in the field of regard.

The following attributes (5) are defined for the other object photodiode current data:

OtherCurrent_Attr = Photodiode current data; <LF>
Fields = Epoch Time, Photodiode Current; <LF>
Units = Seconds, Amps; <LF>
Range = [0.0...5.0E9], [0.0...1.0E-5]; <LF>
Coordinate System = N/A;<LF>

2.8 RADIOMETER POWER DATA

This group contains the receiver heater power (also known as "L1A radiometer power") of each of the three active electronic substitute radiometers (ESRs). By the principle of electrical substitution, changes in the receiver heater power compensate for changes in the optical power incident on the cavity. Because only changes in optical power are detected, to measure the optical power, it is modulated by a shutter that continually cycles from an open-to-closed state with a 50 % duty cycle and a fixed period. The *L1A radiometer power* is the time series of the electronically measured receiver heater power that has been converted to nominal units of Watts and is reported at a 1 second data rate. Conversion to Earth irradiance is performed during level 1B processing, which includes the following: demodulation, subtraction of shutter-modulated background signals that are measured during dark space views, and application of ground calibration data. To facilitate level 1B processing, the NISTAR view information (interpolated), shutter position (in motor steps), and filter wheel position (in motor steps) are reported along with the *L1A radiometer power* at the same 1 Hz data rate.

Table 12 – Radiometer_Power group contents

Dataset	Data type	Description
ModulatedRadiometerPower	Dataset	Contains the radiometric data structure measured at the nominal data rate (VC0)
ModulatedRadiometerPowerDecimated	Dataset	Contains the radiometric data structure measured at the decimated data rate (VC1)

2.8.1 Modulated Radiometer Power

This dataset contains the data structure of L1A radiometric power measured at the nominal VC0 (1 second) data rate.

The new field in v3.0 and above, "isCopied", is an interpolation flag value that indicates the origin of each data entry. This field is introduced because additional interpolation schemes have been employed to fill data gaps. More details can be found in the NISTAR Data Quality Report.

Table 13 – ModulatedRadiometerPower data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.0E9	DSCOVR Epoch time

RadiometerPower1	float64	Watts	-6.6E-5… 6.6E-5	Receiver Cavity 1 power
RadiometerPower2	float64	Watts	-6.6E-5… 6.6E-5	Receiver Cavity 2 power
RadiometerPower3	float64	Watts	-6.6E-5… 6.6E-5	Receiver Cavity 3 power
NISTARView	int32	N/A	-2…4	An integer representing what object(s) is in the NISTAR field of view
ShutterMotor1	int32	N/A	0…205	Receiver Cavity 1 shutter motor position in steps
ShutterMotor2	int32	N/A	0…205	Receiver Cavity 2 shutter motor position in steps
ShutterMotor3	int32	N/A	0…205	Receiver Cavity 3 shutter motor position in steps
FilterWheel	int32	N/A	0…1105	Filter wheel position in steps
IsCopied	short	N/A	0…2	Interpolation flag value: 0 – original data from telemetry 1 – gap less than 6 seconds, use linear interpolation 2 – gap greater than 6 seconds and less than 4 shutter periods, copied from adjacent data

The following attributes (5) are defined for the ModulatedRadiometerPower data:

ModulatedRadiometerPowerAttr = Radiometer Irradiance data; <LF>
Fields = Epoch Time, Radiometer 1 Power, Radiometer 2 Power, Radiometer 3 Power, NISTARView, Shutter Motor Step 1, Shutter Motor Step 2, Shutter Motor Step 3, Filter Wheel Step; <LF>

Units = Seconds, Watts, Watts, Watts, {1 = Earth Only, 2 = Moon Only, 3 = Deep Space, 4 = Earth and Moon, 0 = Partial Earth Only, -1 = Transition, -2 = No Data Available}, N/A, N/A, N/A, N/A; <LF>
Range = [0.0...5.0E9], [-6.6E-5...6.6E-5], [-6.6E-5...6.6E-5], [-6.6E-5...6.6E-5], [-2...4], [0...205], [0...205], [0...205], [0...1105]; <LF>
Coordinate System = N/A;<LF>

2.8.2 Modulated Radiometer Power Decimated

This dataset contains the data structure of L1A radiometric power measured at the decimated VC1 (6 second) data rate. The decimated radiometer power is used only when the nominal VC0 data is not available.

Table 14 – ModulatedRadiometerPowerDecimated data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.0E9	DSCOVR Epoch time
RadiometerPower1	float64	Watts	-6.6E-5… 6.6E-5	Receiver Cavity 1 power
RadiometerPower2	float64	Watts	-6.6E-5… 6.6E-5	Receiver Cavity 2 power
RadiometerPower3	float64	Watts	-6.6E-5… 6.6E-5	Receiver Cavity 3 power
NISTARView	int32	N/A	-2…4	An integer representing what object(s) is in the NISTAR field of view
ShutterMotor1	int32	N/A	0…205	Receiver Cavity 1 shutter motor position in steps
ShutterMotor2	int32	N/A	0…205	Receiver Cavity 2 shutter motor position in steps
ShutterMotor3	int32	N/A	0…205	Receiver Cavity 3 shutter motor position in steps

FilterWheel	int32	N/A	0…1105	Filter wheel position in steps

The following attributes (5) are defined for the ModulatedRadiometerPowerDecimated data:

ModulatedRadiometerPowerDecimatedAttr = Radiometer Irradiance data; <LF>
Fields = Epoch Time, Radiometer 1 Power, Radiometer 2 Power, Radiometer 3 Power, NISTARView, Shutter Motor Step 1, Shutter Motor Step 2, Shutter Motor Step 3, Filter Wheel Step; <LF>
Units = Seconds, Watts, Watts, Watts, {1 = Earth Only, 2 = Moon Only, 3 = Deep Space, 4 = Earth and Moon, 0 = Partial Earth Only, -1 = Transition, -2 = No Data Available}, N/A, N/A, N/A, N/A; <LF>
Range = [0.0...5.0E9], [-6.6E-5...6.6E-5], [-6.6E-5...6.6E-5], [-6.6E-5...6.6E-5], [-2...4], [0...205], [0...205], [0...205], [0...1105]; <LF>
Coordinate System = N/A; <LF>

2.9 GROUND CALIBRATION DATA

This group contains the data used to calibrate the level 1 science data. The data in this section has been determined on the ground and will not change over the course of the mission. Included in this section is such information as the sizes of the apertures, the transmission properties of the filters, and the temperature sensitivity of various optical and electronic components.

Table 15 - Ground_Calibration group contents

Dataset	**Data type**	**Description**
ApertureSeparation	Dataset	Contains the distance between the primary and secondary apertures
FilterTransmissionCurves	Dataset	Contains the filter transmission curves for each filter pair
PTCThermistorResistance	Dataset	Contains the table of resistance versus temperature for PTC thermistors
PrimaryApertureDimensions	Dataset	Contains the physical size of the primary apertures for the four detectors
ReceiverPowerResponsivity	Dataset	Contains the table of responsivity values s. incident power for receiver 1 through 3 and the corresponding uncertainties
SecondaryApertureDimensions	Dataset	Contains the physical size of the secondary apertures for the four detectors

2.9.1 Primary Aperture Dimensions

This dataset contains the physical size of the primary apertures for the four detectors. This data is determined on the ground and does not change.

Dataset Name: "PrimaryApertureDimensions"
Class: "Calibration"

Table 16 - PrimaryApertureDimensions data contents

Field Name	Data Type	Order	Units	Range	Description
Receiver1Area	float32	1	cm^2	0…1	Area of receiver 1 primary aperture
Receiver2Area	float32	1	cm^2	0…1	Area of receiver 2 primary aperture
Receiver3Area	float32	1	cm^2	0…1	Area of receiver 3 primary aperture
PhotodiodeArea	float32	1	cm^2	0…1	Area of photodiode primary aperture

The following attributes (5) are defined for the PrimaryApertureDimensions data:

PrimaryApertureDimensionsAttr = Calibration data; <LF>
Fields = Receiver1Area, Receiver2Area, Receiver3Area, PhotodiodeArea;<LF>
Units = cm^2, cm^2, cm^2, cm^2;<LF>
Range = [0.0…1.0], [0.0…1.0], [0.0…1.0], [0.0…1.0];<LF>
Coordinate System = N/A;<LF>

2.9.2 Secondary Aperture Dimensions

This dataset contains the physical sizes of the secondary apertures for the four detectors. This data is determined on the ground and does not change.

Dataset Name: "SecondaryApertureDimensions"
Class: "Calibration"

Table 17 - SecondaryApertureDimensions data contents

Field Name	Data Type	Order	Units	Range	Description
Receiver1Area	float32	1	cm^2	0…2	Area of receiver 1 secondary aperture
Receiver2Area	float32	1	cm^2	0…2	Area of receiver 2 secondary aperture
Receiver3Area	float32	1	cm^2	0…2	Area of receiver 3 secondary aperture
PhotodiodeArea	float32	1	cm^2	0…2	Area of photodiode secondary aperture

The following attributes (5) are defined for the SecondaryApertureDimensions data:

SecondaryApertureDimensionsAttr = Calibration data; <LF>

Fields = Receiver1Area, Receiver2Area, Receiver3Area, PhotodiodeArea;<LF>
Units = cm^2, cm^2, cm^2, cm^2;<LF>
Range = [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.3 Primary and Secondary Aperture Separation

This dataset contains the distance between the primary and secondary apertures. This distance is the same for all four detectors, and is determined on the ground.

Dataset Name: "ApertureSeparation"
Class: "Calibration"

Table 18 - ApertureSeparation data contents

Field Name	Data Type	Order	Units	Range	Description
ApertureSeparation	float32	1	cm	10…20	Distance between primary and secondary apertures

The following attributes (5) are defined for the ApertureSeparation data:

ApertureSeparationAttr = Calibration data; <LF>
Fields = ApertureSeparation;<LF>
Units = Centimeters;<LF>
Range = [10.0…20.0];<LF>
Coordinate System = N/A;<LF>

2.9.4 Positive Temperature Coefficient (PTC) Thermistors

This dataset contains a table of resistances and corresponding temperatures of the ESR PTC thermistors that were measured on the ground. Note that this data is *not* used to derive science data products—it is only provided as an instrument diagnostic.

Dataset Name: "PTCThermistorResistance"
Class: "Calibration"

Table 19 - Positive temperature coefficient (PTC) thermistors data contents

Field Name	Data Type	Order	Units	Range	Description
Temperature	float32	1	Celsius	-100…100	Temperature of thermistor
Receiver1	float32	1	Ohms	0…25000	Electrical resistance
Receiver2	float32	1	Ohms	0…25000	Electrical resistance

Receiver3	float32	1	Ohms	0…25000	Electrical resistance
HeatSink	float32	1	Ohms	0…25000	Electrical resistance

The following attributes (5) are defined for the PTCThermistorResistance data:

PTCThermistorResistanceAttr = Calibration data; <LF>
Fields = Temperature, Receiver1, Receiver2, Receiver3, HeatSink;<LF>
Units = Celsius, Ohms, Ohms, Ohms, Ohms;<LF>
Range = [-100.0…100.0], [0.0…25000.0], [0.0…25000.0], [0.0…25000.0], [0.0…25000.0];<LF>
Coordinate System = N/A;<LF>

2.9.5 Receiver Power Responsivity at 532 nm

This dataset contains a table of ESR responsivities (and corresponding uncertainties) measured during pre-launch laboratory calibration of NISTAR using calibration light source having a wavelength of 532 nm. The responsivity is the ratio of the measured power to a known incident to incident power.

Dataset Name: "ReceiverPowerResponsivity"
Class: "Calibration"

Table 20 - ReceiverPowerResponsivity data contents

Field Name	Data Type	Order	Units	Range	Description
Reciever1PowerResponsivity	float32	1	N/A	0…2	Radius of receiver 1 power responsivity
Receiver1PowerResponsivityUncertainty	float32	1	N/A	0…2	Radius of receiver 1 power responsivity uncertainty
Reciever2PowerResponsivity	float32	1	N/A	0…2	Radius of receiver 2 power responsivity
Receiver2PowerResponsivityUncertainty	float32	1	N/A	0…2	Radius of receiver 2 power responsivity uncertainty
Reciever3PowerResponsivity	float32	1	N/A	0…2	Radius of receiver 3 power responsivity
Receiver3PowerResponsivityUncertainty	float32	1	N/A	0…2	Radius of receiver 3 power responsivity uncertainty

The following attributes (5) are defined for the ReceiverPowerResponsivity data:

ReceiverPowerResponsivityAttr = Calibration data; <LF>
Fields = IncidentPower, Receiver1PowerResponsivity, Receiver1PowerResponsivityUncertainty, Receiver2PowerResponsivity, Receiver2PowerResponsivityUncertainty, Receiver3PowerResponsivity, Receiver3PowerResponsivityUncertainty;<LF>
Units = Watts, N/A, N/A, N/A, N/A, N/A, N/A;<LF>
Range = [0.0…1.0E-4], [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0], [0.0…2.0];<LF>
Coordinate System = N/A;<LF>

2.9.6 Filter B Transmission Curves

This dataset contains the table of band B (200 nm to 4 µm) filter transmission curves covering 200 nm to 18 µm for each of the 3 filter pairs (Note that each "filter", e.g. 7B1, has 2 filters – one for bandpass filtering, and one for thermal filtering). The names in the table correspond to the code *xyz* where *x* = wheel position (1-12), *y* = filter band (A-C) and *z* = the number of the filter (there are 3 B filters, and 3 C filters, and 6 slots with no filter). These data are determined once on the ground in the laboratory. Also note that each filter is fixed in its wheel position, e.g., wheel position 1 always has filter C1 in it.

Dataset Name: "FilterBTransmissionCurves"
Class: "Calibration"

Table 21 - FilterBTransmissionCurves data contents

Field Name	Data Type	Order	Units	Range	Description
IncidentWavelength	float32	1	Micrometers	0…20	Incident wavelength in µm
7B1	float32	1	N/A	0…1	Transmission ratio
11B2	float32	1	N/A	0…1	Transmission ratio
2B3	float32	1	N/A	0…1	Transmission ratio

The following attributes (4) are defined for the FilterBTransmissionCurves data:

FilterBTransmissionCurvesAttr = Calibration data; <LF>
Fields = IncidentWavelength, 7B1, 11B2, 2B3;<LF>
Units = Micrometer, N/A, N/A, N/A;<LF>
Range = [0.0…20.0], [0.0…1.0], [0.0…1.0], [0.0…1.0];<LF>

2.9.7 Filter C Transmission Curves

This dataset contains the table of band C (720 nm to 4 µm) filter transmission curves covering 200 nm to 18 µm for each of the 3 filter pairs.

Dataset Name: "FilterCTransmissionCurves"
Class: "Calibration"

Table 22 - FilterCTransmissionCurves data contents

Field Name	Data Type	Order	Units	Range	Description
IncidentWavelength	float32	1	Micrometers	0…20	Incident wavelength in µm
1C1	float32	1	N/A	0…1	Transmission ratio
5C2	float32	1	N/A	0…1	Transmission ratio
8C3	float32	1	N/A	0…1	Transmission ratio

The following attributes (4) are defined for the FilterCTransmissionCurves data:

FilterCTransmissionCurvesAttr = Calibration data; <LF>
Fields = IncidentWavelength, 1C1, 5C2, 8C3;<LF>
Units = Micrometer, N/A, N/A, N/A;<LF>
Range = [0.0…20.0], [0.0…1.0], [0.0…1.0], [0.0…1.0];<LF>

2.10 ON-ORBIT CALIBRATION DATA

This group is used to calibrate the level 1 science data. These calibration tables are created and modified based on measurements taken while the spacecraft is in operation (as opposed to the ground-based calibration data described in the previous section).

Table 23 – On-orbit_Calibration group contents

Dataset	Data type	Description
ServoSettlingErrorCorrection	Dataset	Contains the scaling factor to correct the servo-settling error
DemodulationPhaseCorrection	Dataset	Contains the phase correction to the demodulated power
InstrumentPointingCorrection	Dataset	Contains the pointing correction between the NISTAR and the EPIC instruments
PhotodiodeDarkCurrent	Dataset	Contains the dark current of the photodiode
RadiometerDarkPower	Dataset	Contains the background power lost to space from the radiometer
AnomalousData	Dataset	Contains the time intervals of anomalous data

2.10.1 Servo-Settling Error Correction

This dataset contains the correction to the radiometric signal due to an observed transient effect in the servo-settling of the thermal control. The transient comes from the improperly configured servo feedforward and consequently comes into the Earth signal as a small overshoot. This calibration provides the scaling factor to remove the transient effect.

Dataset Name: ServoSettlingErrorCorrection
Class: Calibration

Table 24 - ServoSettlingErrorCorrection measurements group data contents

Field Name	Data Type	Order	Units	Range	Description
StartingJulianDay	float64	1	Days	0… 3E6	The starting Julian day for this correction
ServoSettlingCorrectionFactor	float64	1	N/A	0… 2.0	The scaling factor to correct the overshoot
ServoSettlingCorrectionFactorUncertainty	float64	1	N/A	0… 2.0	The uncertainty of the scaling factor

The following attributes (4) are defined for the ShutterDemodulationCorrection data:

ShutterDemodulationCorrectionAttr= Calibration data; <LF>
Fields = StartingJulianDay, DemodulationCorrectionFactor,
DemodulationCorrectionFactorUncertainty;<LF>
Units = Days, N/A, N/A<LF>
Range = [0.0…3E6], [0.0…2.0], [0.0…2.0];<LF>

2.10.2 Demodulation Phase Error Correction

This dataset contains the correction to the radiometric signal due to the phase error between the modulated radiometer power and the shutter positions. Due to the limited knowledge of the actual shutter position, there is a phase lag in the commanded shutter position, which is used as the reference signal in the demodulation process. The phase error is evaluated on-orbit and used to correct the demodulated radiometer power data.

Dataset Name: DemodulationPhaseCorrection
Class: Calibration

Table 25 - DemodulationPhaseCorrection measurements data contents

Field Name	Data Type	Order	Units	Range	Description
StartingJulianDay	float64	1	Days	0… 3E6	The starting Julian day for this correction
DemodulationPhaseCorrection	float64	1	Radians	0… 2π	The phase error in shutter position
DemodulationPhaseCorrectionUncertainty	float64	1	Radians	0… 2π	Uncertainty of the phase error in shutter position

The following attributes (4) are defined for the DemodulationPhaseCorrection data:

DemodulationPhaseCorrectionAttr = Calibration data; <LF>

Fields = StartingJulianDay, DemodulationPhaseCorrection,
DemodulationPhaseCorrectionUncertainty;<LF>
Units = Days, Radians, Radians<LF>
Range = [0.0…3E6], [0.0…2π], [0.0…2π];<LF>

2.10.3 Pointing Correction with Respect to EPIC

This dataset contains the pointing corrections between the NISTAR and the EPIC instruments in the spacecraft reference frame. These values are measured once at the beginning of the mission and again when the spacecraft reaches its final destination orbit (so at least 2 records).

Dataset Name: "InstrumentPointingCorrection"
Class: "Calibration"

Table 26 - InstrumentPointingCorrection data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.0E9	DSCOVR Epoch time
AttitudeMatrixRow1	float64	3	N/A	-1…1	Row 1 of the Euler form of the attitude matrix as calculated from the quaternion
AttitudeMatrixRow2	float64	3	N/A	-1…1	Row 2 of the Euler form of the attitude matrix as calculated from the quaternion
AttitudeMatrixRow3	float64	3	N/A	-1…1	Row 3 of the Euler form of the attitude matrix as calculated from the quaternion

The following attributes (4) are defined for the InstrumentPointingCorrection data:

InstrumentPointingCorrectionAttr = Calibration data; <LF>
Fields = Epoch Time, Row 1 of Matrix {(1,1), (1,2), (1,3)}, Row 2 of Matrix {(2,1), (2,2), (2,3)}, Row 3 of Matrix {(3,1), (3,2), (3,3)};<LF>
Units = Seconds, N/A, N/A, N/A<LF>
Range = [0.0…5.0E9], [-1.0…1.0], [-1.0…1.0], [-1.0…1.0];<LF>

2.10.4 Photodiode Dark Current Offset Measurements

This dataset contains photodiode dark current offset measured versus time. These data are the averaged photodiode current when the spacecraft slew by approximately 4 degrees for a 2-hour deep space view once a month.

Dataset Name: PhotodiodeDarkCurrent
Class: Calibration

Table 27 - PhotodiodeDarkCurrent measurements data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0… 5.0E9	DSCOVR Epoch time
PhotodiodeDarkCurrent	float64	1	Amps	0… 6E-5	Current when photodiode is looking into deep space

The following attributes (4) are defined for the PhotodiodeDarkCurrent data:

PhotodiodeDarkCurrentAttr = Calibration data; <LF>
Fields = DSCOVREpochTime, PhotodiodeDarkCurrent;<LF>
Units = Seconds, Amps<LF>
Range = [0.0…5.0E9], [0.0…6.0E-5];<LF>

2.10.5 Radiometer Dark Power Offset Measurements

This dataset contains radiometer dark power offset measured versus time. These data are the averaged radiometer heater power when the spacecraft slew by approximately 4 degrees for a 2-hour deep space view once a month. Due to the principle of an ESR, this radiometer heater power is a measure of the overall background power of the instrument lost into space. The dark power offset of radiometers, in contrast to the photodiode, is more susceptible to the change of operation configurations such as the shutter autocycle period and the PID parameters. The calibration data specifies the corresponding shutter autocycle period for each dark space measurement.

Dataset Name: RadiometerDarkPower
Class: Calibration

Table 28 - RadiometerDarkPower measurements data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0… 5.0E9	DSCOVR Epoch time
AutocyclePeriod	float64	1	Minutes	0… 60.0	Shutter autocycle period, 0 means autocycle off
Receiver1DarkPower	float64	1	Watts	-6.6E-5…6.6E-5	Heater power of RC1 when looking into deep space
Receiver2DarkPower	float64	1	Watts	-6.6E-5…6.6E-5	Heater power of RC2 when looking into deep space
Receiver3DarkPower	float64	1	Watts	-6.6E-5…6.6	Heater power of RC3 when looking into deep

				E-5	space

The following attributes (4) are defined for the RadiometerDarkPower data:

PhotodiodeDarkCurrentAttr = Calibration data; <LF>
Fields = DSCOVREpochTime, AutocyclePeriod, Receiver1DarkPower, Receiver2DarkPower, Receiver3DarkPower;<LF>
Units = Seconds, Minutes, Watts, Watts, Watts<LF>
Range = [0.0…5.0E9], [0.0…60.0], [-6.6E-5…6.6E-5], [-6.6E-5…6.6E-5], [-6.6E-5…6.6E-5];<LF>

2.10.6 Anomalous Data

This dataset contains the time periods during which the radiometers have acquired data unsuitable for deriving science data products. The cause of anomalous data includes, but is not limited to, spacecraft maneuvers, instrument built-in-test errors and safe mode, and other special commanding. The information of anomalous time periods is applied to the radiometric science data in level 1B processing. Note that in addition to the anomalous data, data obtained within the extra two shutter cycles before and after the anomalous time period is also dropped, due to the algorithm of 4-period boxcar filters in the demodulation.

Dataset Name: AnomalousData
Class: Calibration

Table 29 - AnomalousData measurements data contents

Field Name	Data Type	Order	Units	Range	Description
JulianDay	float64	1	Days	0… 3E6	Julian day
StartHour	float64	1	Hours	0… 24.0	The start hour of anomalous data segment
EndHour	float64	1	Hours	0… 24.0	The end hour of anomalous data segment

The following attributes (4) are defined for the AnomalousData data:

AnomalousDataAttr = Calibration data; <LF>
Fields = JulianDay, StartHour, EndHour;<LF>
Units = Days, Hours, Hours;<LF>
Range = [0.0…3.0E6], [0.0…24.0], [0.0…24.0];<LF>

2.10.7 Anomalous Photodiode Data

This dataset contains the time periods during which the photodiode has acquired data unsuitable for deriving science data products. The cause of anomalous photodiode data includes, but is not limited to, spacecraft maneuvers, instrument built-in-test errors and safe mode, and other special commanding. Since the photodiode is an independent instrument against the radiometers, the anomalous time periods can be different. Also, unlike the anomalous radiometer data, photodiode current data within the extra two shutter cycles before and after the anomalous time period is not truncated.

Dataset Name: AnomalousPhotodiodeData
Class: Calibration

Table 30 - AnomalousPhotodiodeData measurements data contents

Field Name	Data Type	Order	Units	Range	Description
JulianDay	float64	1	Days	0… 3E6	Julian day
StartHour	float64	1	Hours	0… 24.0	The start hour of anomalous data segment
EndHour	float64	1	Hours	0… 24.0	The end hour of anomalous data segment

The following attributes (4) are defined for the AnomalousPhotodiodeData data:

AnomalousPhotodiodeDataAttr = Calibration data; <LF>
Fields = JulianDay, StartHour, EndHour;<LF>
Units = Days, Hours, Hours;<LF>
Range = [0.0…3.0E6], [0.0…24.0], [0.0…24.0];<LF>

2.11 GEOLOCATION DATA

The geolocation data are sets of ephemeris and attitude information which are used as input to several algorithms which compute Earth and Moon subsatellite points, Earth and Moon gibbous fractions, and the objects within the NISTAR view. The geolocation data consists of nine datasets as described in the following tables.

Table 31 – Geolocation_Data group contents

Dataset	Data type	Description
SpacecraftEphemeris	Dataset	Contains the DSCOVR ephemeris data
EarthSubsatellitePoint	Dataset	Contains the latitude and longitude of the satellite point on the surface of the Earth
LunarEphemeris	Dataset	Contains the Lunar ephemeris data

LunarSubsatellitePoint	Dataset	Contains the latitude and longitude of the satellite point on the surface of the Moon
SolarEphemeris	Dataset	Contains the Solar ephemeris data
InstrumentAttitudeMatrix	Dataset	Contains the matrix that indicates the pointing direction of the instrument
NISTARView	Dataset	Contains an integer from -2 to 4 representing what celestial object is in the FOV of the instrument. 0 – Earth is in the FOR but not entirely in the FOV 1 – Only Earth is in the FOV (nominal) 2 – Only Moon is in the FOR 3 – Neither Earth or Moon is in the FOR (e.g., deep space) 4 – Both Earth and Moon are in the FOR -1 – Spacecraft in transition -2 – No data available
EarthCentroidCoord	Dataset	Contains Earth centroid coordinates
LunarCentroidCoord	Dataset	Contains Lunar centroid coordinates

2.11.1 Spacecraft Ephemeris

The DSCOVR Ephemeris data comes from either the definitive ephemeris file, which is one record per minute, or the predicted ephemeris file (which is one record every 10 minutes). Each of the geolocation tables should have one days' worth of data, so once per minute would give 1440 records and once per 10 minutes would give 144 records. The requirements on the predicted ephemeris put the irradiances within the tolerance (so one does not gain anything by waiting for the definitive ephemeris).

Data specifies the DSCOVR spacecraft position and velocity in geocentric rectangular inertial J2000 coordinates.

Dataset Name: SpacecraftEphemeris
Class: Geolocation

Table 32 – Spacecraft Ephemeris data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.0E9	DSCOVR Epoch time
Position	float64	3	Km	-3.0E6… 3.0E6	X, y, z components of position
Velocity	float64	3	Km/s	-11.0… 11.0	X, y, z, components of velocity

The following attributes (5) are defined for the SpacecraftEphemeris data:

SpacecraftEphemerisAttr = Spacecraft Ephemeris data;<LF>

Fields = Epoch Time, Position (x,y,z), Velocity (x,y,z);<LF>
Units = Seconds, Kilometers, Kilometers per Second;<LF>
Range = [0.0…5.0E9], [-3.0E6…3.0E6], [-11.0…11.0];<LF>
Coordinate System = J2000 Geocentric Inertial;<LF>

2.11.2 Instrument Attitude Matrices

The attitude matrix, which describes the pointing direction of the NISTAR instrument in geocentric rectangular inertial J2000 coordinates at the image exposure time. These data form a 3x3 matrix where each record in the dataset is a row of its respective matrix. Each field contains the three values for the column of the respective matrix. Earth field contains the three values for the column for the respective matrix. These data indicate the direction that the instrument is pointing.

Dataset Name: InstrumentAttitudeMatrix
Class: Geolocation

Table 33 - InstrumentAttitudeMatrix data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.0E9	DSCOVR Epoch time
AttitudeMatrixRow1	float64	3	N/A	-1…1	Row 1 of the Euler form of the attitude matrix as calculated from the quaternion
AttitudeMatrixRow2	float64	3	N/A	-1…1	Row 2 of the Euler form of the attitude matrix as calculated from the quaternion
AttitudeMatrixRow3	float64	3	N/A	-1…1	Row 3 of the Euler form of the attitude matrix as calculated from the quaternion

The following attributes (5) are defined for the InstrumentAttitudeMatrix data:

InstrumentAttitudeMatrixAttr = Attitude Matrix data; <LF>
Fields = Epoch Time, Row 1 of Matrix {(1,1), (1,2), (1,3)}, Row 2 of Matrix {(2,1), (2,2), (2,3)}, Row 3 of Matrix {(3,1), (3,2), (3,3)};<LF>
Units = Seconds, N/A, N/A, N/A;<LF>
Range = [0.0…5.0E9], [-1.0…1.0], [-1.0…1.0] , [-1.0…1.0];<LF>
Coordinate System = Local Spacecraft Axes;<LF>

2.11.3 Lunar Ephemeris

This dataset describes the Moon's position and velocity in geocentric rectangular inertial J2000 coordinates interpolated to the image collection time.

Dataset Name: LunarEphemeris
Class: Geolocation

Table 34 - LunarEphemeris data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.0E9	DSCOVR Epoch time
Position	float64	3	Km	-2.0E6 …2.0E6	X, y, z components of position
Velocity	float64	3	Km/s	-11.0… 11.0	X, y, z, components of velocity

The following attributes (5) are defined for the LunarEphemeris data:

LunarEphemerisAttr = Spacecraft Ephemeris data; <LF>
Fields = Epoch Time, Position (x,y,z), Velocity (x,y,z);<LF>
Units = Seconds, Kilometers, Kilometers per Second;<LF>
Range = [0.0…5.0E9], [-2.0E6…2.0E6], [-11.0…11.0];<LF>
Coordinate System = J2000 Geocentric Inertial;<LF>

2.11.4 Earth Subsatellite Location

This dataset contains the latitude and longitude of the spacecraft's subsatellite point, i.e., the latitude and longitude of the point on the surface of the Earth pierced by a straight line connecting the center of the Earth and the spacecraft. The longitude angle has a range of -180 to 180 degrees, where -180 corresponds to 180 degrees west longitude. Similarly, -90 degrees latitude corresponds to 90 degrees south latitude.

Dataset Name: EarthSubsatellitePoint
Class: Geolocation

Table 35 - EarthSubsatellitePoint data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.0E9	DSCOVR Epoch time
Latitude	float64	1	Degrees	-90…90	Latitude of the subsatellite point as calculated from ephemeris data

Longitude	float64	1	Degrees	-180…180	Longitude of the subsatellite point as calculated from ephemeris data
SunAngle	float64	1	Degrees	0…180	Solar-Earth-DSCOVR angle

The following attributes (5) are defined for the EarthSubsatellitePoint data:

EarthSubsatellitePointAttr = Subsatellite Latitude/Longitude data;<LF>
Fields = Epoch Time, Latitude, Longitude, SunAngle;<LF>
Units = Seconds, Degrees, Degrees, Degrees;<LF>
Range = [0.0…5.0E9], [-90.0…90.0], [-180.0…180.0], [0.0…180.0];<LF>
Coordinate System = Geographic latitude/longitude;<LF>

2.11.5 Lunar Subsatellite Location

This dataset contains the latitude and longitude of the spacecraft's subsatellite point, i.e., the latitude and longitude of the point on the surface of the Moon pierced by a straight line connecting the center of the Moon and the spacecraft. The latitude and longitude are given in lunar geographic (a.k.a, Selenographic) coordinates. See Escobal (1965).

Dataset Name: LunarSubsatellitePoint
Class: Geolocation

Table 36 - LunarSubsatellitePoint data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.0E9	DSCOVR Epoch time
Latitude	float64	1	Degrees	-90…90	Latitude of the subsatellite point as calculated from ephemeris data
Longitude	float64	1	Degrees	-180…180	Longitude of the subsatellite point as calculated from ephemeris data
SunAngle	float64	1	Degrees	0…180	Solar-Moon-DSCOVR angle

The following attributes (5) are defined for the LunarSubsatellitePoint data:

LunarSubsatellitePointAttr = Subsatellite Latitude/Longitude data; <LF>
Fields = Epoch Time, Latitude, Longitude, SunAngle;<LF>
Units = Seconds, Degrees, Degrees, Degrees;<LF>
Range = [0.0…5.0E9], [-90.0…90.0], [-180.0…180.0] , [0.0…180.0];<LF>
Coordinate System = Geographic latitude/longitude;<LF>

2.11.6 NISTAR View

This field indicates the instrument pointing with respect to the Earth, Moon and deep space. The indicators are used to determine when a radiometrically valid measurement can be made of the Earth or the background (deep space). In order to accurately measure radiation from the Earth, it must lie entirely within the NISTAR 1-degree Field-of-View (FOV), and the Moon must lie outside the NISTAR 7-degree Field-of-Regard (FOR). When this condition is met, the NISTARView parameter has a value of 1. When the Earth lies within the FOR but not entirely within the FOV, and the Moon is outside the FOR, the value is 0. When the Moon exclusively falls within the FOR, the parameter is 2. When neither the Moon nor the Earth are within the FOR, i.e., when viewing deep space, the parameter is 3. A value of 4 indicates that both the Earth and the Moon are within the FOR.

Dataset Name: NISTARView
Class: Geolocation

Table 37 - NISTARView data contents

Field Name	Data Type	Order	Units	Range	Description
DscovrEpochTime	float64	1	Seconds	0…5.0E9	DSCOVR Epoch time
NISTARView	uint8	1	N/A	-2…4	An integer representing what object(s) is in the NISTAR field of view

The following attributes (5) are defined for the NISTARView data:

NISTARViewAttr = NISTAR View data; <LF>
Fields = Epoch Time, NISTARView;<LF>
Units = Seconds, N/A;<LF>
Range = [0.0…5.0E9], [-2…4];<LF>
Coordinate System = N/A;<LF>

2.11.7 Solar Ephemeris

Describes the Sun's apparent position and velocity in geocentric rectangular inertial J2000 coordinates interpolated to the image collection time

Dataset Name: SolarEphemeris
Class: Geolocation

Table 38 - SolarEphemeris data contents

Field Name	Data Type	Order	Units	Range	Description

DscovrEpochTime	float64	1	Seconds	0…5.0E9	DSCOVR Epoch time
Position	float64	3	Km	-3E6…3E6	X, y, z components of position
Velocity	float64	3	Km/s	-11…11	X, y, z, components of velocity

The following attributes (5) are defined for the SolarEphemeris data:

SolarEphemerisAttr = Spacecraft Ephemeris data; <LF>
Fields = Epoch Time, Position (x,y,z), Velocity (x,y,z);<LF>
Units = Seconds, Kilometers, Kilometers per Second;<LF>
Range = [0.0…5.0E9], [-3.0E8…3.0E8], [-100.0…100.0];<LF>
Coordinate System = J2000 Geocentric Inertial;<LF>

2.11.8 Earth Centroid Coordinates

This dataset contains the Earth centroid coordinates which map to the photodiode current values. The terrestrial geographic coordinates map to their respective current data sets with a cardinality of 1:100. In other words, one coordinate data point maps to each 100 current data points or every 10 seconds of time. If the Moon is also included in the field of view, only the centroid coordinates of the Earth are given.

Table 39 - Earth centroid coordinates data

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	8,640	Seconds	0…5E9	DSCOVR epoch time Earth
Latitude	float64	8,640	Degrees	-90.0…90.0	Latitude values
Longitude	float64	8,640	Degrees	-180.0…180.0	Longitude values

The following attributes (5) are defined for the Earth photodiode data:

EarthCentroidCoordinatesAttr = Centroid Latitude/Longitude data; <LF>
Fields = Epoch Time, Latitude, Longitude;<LF>
Units = Seconds, Degrees, Degrees;<LF>
Ranges = [0.0…5.0E9], [-90.0…90.0], [-180.0…180.0];<LF>
Coordinate System = Geographic latitude/longitude;<LF>

2.11.9 Lunar Centroid Coordinates

This dataset contains the Lunar Centroid Coordinates, which map to the photodiode current data. The lunar geographic coordinates map to their respective current data sets with a cardinality of 1:100. In other words, one coordinate data point maps to each 100 current data points or every 10 seconds of time.

Table 40 - Lunar centroid coordinates data

Dataset	Data type	Order	Units	Range	Description
Epoch Time	float64	8,640	Seconds	0…5E9	DSCOVR epoch time Earth
Latitude	float64	8,640	Degrees	-90.0…90.0	Latitude values
Longitude	float64	8,640	Degrees	-180.0…180.0	Longitude values

The following attributes (5) are defined for the lunar photodiode data:

LunarCentroidCoordinatesAttr = Centroid Latitude/Longitude data; <LF>
Fields = Epoch Time, Latitude, Longitude;<LF>
Units = Seconds, Degrees, Degrees;<LF>
Ranges = [0.0…5.0E9], [-90.0…90.0], [-180.0…180.0];<LF>
Coordinate System = Geographic latitude/longitude;<LF>

2.12 METADATA

Each file shall have a global attribute called “metadata” attached to it. This is an HDF attribute. The metadata attribute shall contain information about the product. It is a single character string with each *name=value* parameter is delimited by a “;<LF>” character set. The <LF> character is defined as ASCII code 0A (hexadecimal). The metadata items are stored in a single HDF attribute in one continuous string delimited by “;\n”.

The values in the latitude and longitude fields shall be the geographic coordinates of the specified pixels in the Earth image. The centroids of the images are defined as the center of the Earth disk as it appears in the image.

The values are stored under the root Attributes of the HDF file.

Attibute: Metadata

Table 41 - Level 1A product metadata

Field Name	Data Type	Order	Units	Range	Description
Name	String	114	N/A	N/A	Deep Space Climate Observatory National Institute of Standards and Technology Advanced Radiometer Level 1A Product

Summary	String	112	N/A	N/A	This dataset contains a NISTAR level 1A dataset. Contains summary radiometer, calibration, and geolocation data.
Keywords	String	96	N/A	N/A	DSCOVR, NISTAR, radiometer, L1A, lagrange, infrared, thermal, radiation, L-1, radiometer, cavity
Project	String	30	N/A	N/A	Deep Space Climate Observatory
Producer_granule_id	String	34	N/A	N/A	The name of the HDF file (no null terminator at the end of string).
File_creation_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the time that the file was created, the time that the data was processed.
Beginning_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the beginning time of the view period, i.e., the start point of the 24hr period that the product contains data for. Usually, it is 12:00:00 of the prior date.
End_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the end time of the view period, i.e., the end point of the 24hr period that the product contains data for. Usually, it is 11:59:59 of the reported date.
Granule_version	String	5	N/A	01… 99	The processing version number of the product. For decimal version numbers, an additional string "_d" is appended, where d represents the decimal part.

Comment	String	40	N/A	N/A	The miscellaneous text comment on the product. Null value="NULL".
Centroid_latitude	String	7	Degrees	-90… 90	The latitude of the image centroid, E.g., 37.25. Null value="NULL"
Centroid_longtidue	String	8	Degrees	-180… 180	The longitude of the image centroid E.g., -173.28. Null value="NULL"
Percent_data_available	String	4	Percentage	0… 100	Indicates the percentage of data expected in a 24-our interval actually available in the product
Data_quality	String	5	N/A	GOOD or BAD	Indicates if the quality of the data in the product is good enough for scientific analysis (GOOD) or not (BAD)

Metadata Text Format:

Name=Deep Space Climate Observatory National Institute of Standards and Technology Advanced Radiometer Level 1A Product;<LF>
Summary=This dataset contains a NISTAR level 1A dataset. Contains summary radiometer, calibration, and geolocation data. ;<LF>
Keywords=DSCOVR, NISTAR, radiometer, L1A, lagrange, infrared, thermal, radiation, L-1, radiometer, cavity;<LF>
Project=Deep Space Climate Observatory;<LF>
Begin_Date= yyyy-mm-dd+hh:mm:ss;<LF>
End_Date= yyyy-mm-dd+hh:mm:ss;<LF>
Current_Date= yyyy-mm-dd+hh:mm:ss;<LF>
Producer_granule_id= nist_1a_xxxxxxxx_xxxxxxx_xx.h5;<LF>
Granule_version= xx/xx_x;<LF>
Comment=NISTAR Level 1A Data.;<LF>
Centroid_latitude=+/-xx.xx;<LF>
Centroid_longitude=+/-xxx.xx;<LF>
Percent_data_available= xxx;<LF>
Data_quality= GOOD/BAD;<LF>

3 NISTAR LEVEL 1B DATA PRODUCT

3.1 PRODUCT OVERVIEW

The NISTAR level 1B data products are generated from the level 1A products, which include the time series of the measured ESR cavity heater power and that of the measured photodiode current. For the radiometers, the level 1A radiometer power is first demodulated and then offset

(background) corrected using the demodulated power measured during observations of dark space. The result is reported as the 1B Earth power, which is subsequently converted to Earth irradiance in units of W/m^2, and then to Earth radiance in units of $W/m^2/sr$. The former is calculated by dividing the 1B Earth power by a receiver-dependent calibration constant. The latter is calculated by further dividing by the solid angle of the Earth subtended from DSCOVR, calculated as $\pi(Re/D)^2$, where Re is the Earth mean radius, and D is the distance between Earth and DSCOVR. Note that the 1B data products are not corrected using the transmittance of the band B or C filters. Such corrections may be developed using the provided filter transmittance data together with a user-provided model of the spectral content of the Earth-outgoing radiation.

For the photodiode measurements, the 1B data includes the photodiode Earth current, which is the 1A photocurrent measured during earth observation with the "dark" photocurrent, measured during observation of dark space, subtracted. In addition, a distance-independent photodiode current is obtained by multiplying the Earth current by $(D/D_n)^2$, where D_n is approximately 1.49×10^6 km.

As the last step of the level 1B processing, the Earth irradiance, radiance, and current are averaged, separately, over a 4-hour and 1-day window. Due to instrument noise, an averaging of at least four hours of the radiometer data is recommended; however, the Earth irradiance data which is reported at a one second cadence can be averaged to a period of the user's choosing. Level 1B products files contain data for an entire Julian Earth day. A Julian day is defined as the interval of time from 12:00:00.00h to 11:59:59.99h the following day URTC. The level 1A and level 1B data products are stored in separate HDF files at the ASDC. The time scale in most of the data objects described here is "DSCOVR epoch time." This is the number of seconds since 00:00:00.00 hours, 24, May, 1968 UTC or Julian day number 2,440,000.5.

Unlike level 1A products, the number of significant digits in all level 1B radiometry datasets has been adjusted to eliminate excessive digits (Version 2.1 and above).

Table 42 – L1B Data Group Types

Group	Contents
Demodulated_Power	Contains the heater power of ESRs demodulated from L1A radiometer power data in 1 second cadence.
Earth_Irradiance	Contains the Earth irradiance data in the total and filtered bands, converted from the offset-corrected demodulated power.
Binned_Averages	Contains the Earth irradiance, radiance and photodiode current averaged over a 4-hour and 1-day window.
Ground_Calibration	Contains 6 datasets, each containing laboratory-determined calibration information for the instrument. This ground-calibration information is used to convert instrument readings into irradiances.
On-orbit_Calibration	Contains calibration data used in converting instrument readings to irradiances. One example of on-orbit calibration data is the photodiode "dark current" which has to be measured regularly over the lifetime of the mission because it can change.

3.2 DATA VOLUMES

Each NISTAR level 1B product contains up to approximately 17 MB of data. The values given in Table 40 are the maximum possible sizes. With compression in HDF5, the actual size of the level 1B product is less than 10 MB. The calibration data from groups "Ground_Calibration" and "On-orbit_Calibration" are same as in the level 1A product so they are not described in this section.

Table 43 - L1B data volumes by group and dataset

Group	Dataset	Record Size (bytes)	Number Records	Object Size (bytes)
Demodulated_Power	DemodulatedRadiometerPower	76	86400	6,566,400
Earth_Irradiance	BandA_EarthIrradiance	40	86400	3,456,000
	BandB_EarthIrradiance	40	86400	3,456,000
	BandC_EarthIrradiance	40	86400	3,456,000
Binned_Averages	EarthIrradiancesFourHour	136	24	3264
	EarthIrradiancesDaily	136	1	136
Ground_Calibration	PrimaryApertureDimensions	16	1	16
	SecondaryApertureDimensions	16	1	16
	ApertureSeparation	4	1	4
	PTCThermistorResistance	20	58	1,160
	ReceiverPowerResponsivity	28	1	28
	FilterBTransmissionCurves	16	363	5,808
	FilterCTransmissionCurves	16	548	8,768
On-orbit_Calibration	ServoSettlingCorrection	12	3	36
	DemodulationPhaseCorrection	12	3	36
	InstrumentPointingCorrection	80	1	80
	PhotodiodeDarkCurrent	12	100	1,200
	RadiometerDarkPower	40	21,600	864,000
	AnomalousData	12	1,800	21,600
Attributes (embedded in each dataset)	PrimaryApertureDimensionsAttr	205	1	205
	SecondaryApertureDimensions Attr	205	1	205
	ApertureSeparationAttr	116	1	116
	PTCThermistorResistanceAttr	243	1	243
	ReceiverPowerResponsivityAttr	377	1	377
	FilterBTransmissionCurvesAttr	185	1	185
	FilterCTransmissionCurvesAttr	184	1	184
	ServoSettlingErrorCorrectionAttr	216	1	216
	DemodulationPhaseCorrection Attr	220	1	220

	InstrumentPointingCorrectionAttr	299	1	299
	PhotodiodeDarkCurrentAttr	154	1	154
	RadiometerDarkPowerAttr	274	1	274
	AnomalousDataAttr	162	1	162
	DemodulatedRadiometerPower Attr	1410	1	1410
	BandA_EarthIrradianceAttr	1326	1	1326
	BandB_EarthIrradianceAttr	1326	1	1326
	BandC_EarthIrradianceAttr	1326	1	1326
	EarthIrradiancesFourHourAttr	2106	1	2106
	EarthIrradiancesDailyAttr	2106	1	2106
Metadata	Metadata Attr	365	1	365
Approximate Total Size				17,853,357

3.3 DEMODULATED POWER DATA

This group is the result of the phase sensitive demodulation of the input L1A radiometer power to extract the amplitude of the square wave. As described above, in the case of autocycle off mode the data is simply a running mean of the input signal.

3.3.1 Demodulated Radiometer Power

This dataset contains the demodulated radiometer power as measured by the three active cavity detectors. The data rate is the nominal best available rate, and the data is not manually filtered for thermal stability. For autocycle on data, the data is a result of the phase sensitive four boxcar demodulation, and for autocycle off data, the data is a running mean of the input signal.

Both the real and imaginary components of the demodulation are provided in this dataset. Note that they are already corrected by the phase error between the modulated radiometer power and its referencing shutter position.

Table 44 – DemodulatedRadiometerPower data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.0E9	DSCOVR Epoch time at the midpoint of the boxcar window
DemodulatedRadiometer Power1	float64	Watts	-6.6E-5 …6.6E-5	Receiver Cavity 1 demodulated power

DemodulatedRadiometer Power2	float64	Watts	-6.6E-5 …6.6E-5	Receiver Cavity 2 demodulated power
DemodulatedRadiometer Power3	float64	Watts	-6.6E-5 …6.6E-5	Receiver Cavity 3 demodulated power
DemodulatedRadiometer Power1Im	float64	Watts	-6.6E-5 …6.6E-5	Receiver Cavity 1 demodulated power (imaginary component)
DemodulatedRadiometer Power2Im	float64	Watts	-6.6E-5 …6.6E-5	Receiver Cavity 2 demodulated power (imaginary component)
DemodulatedRadiometer Power3Im	float64	Watts	-6.6E-5 …6.6E-5	Receiver Cavity 3 demodulated power (imaginary component)
NISTARView	int32	N/A	-2…4	An integer representing what object(s) is in the NISTAR field of view
ShutterMotor1	int32	N/A	0…205	Receiver Cavity 1 shutter motor position in steps
ShutterMotor2	int32	N/A	0…205	Receiver Cavity 2 shutter motor position in steps
ShutterMotor3	int32	N/A	0…205	Receiver Cavity 3 shutter motor position in steps
FilterWheel	int32	N/A	0…1105	Filter wheel position in steps

The following attributes (5) are defined for the DemodulatedRadiometerPower data:

DemodulatedRadiometerPowerAttr = Demodulated Radiometer Power data;<LF>
Fields = Epoch Time, Demodulated Radiometer 1 Power, Demodulated Radiometer 2 Power, Demodulated Radiometer 3 Power, Demodulated Radiometer 1 Power Imaginary Component, Demodulated Radiometer 2 Power Imaginary Component, Demodulated Radiometer 3 Power

Imaginary Component, NISTARView, Shutter Motor Step 1, Shutter Motor Step 2, Shutter Motor Step 3, Filter Wheel Step;<LF>
Units = Seconds, Watts, Watts, Watts, Watts, Watts, Watts, {1 = Earth Only, 2 = Moon Only, 3 = Deep Space, 4 = Earth and Moon, 0 = Partial Earth Only, -1 = Transition, -2 = No Data Available}, N/A, N/A, N/A, N/A;<LF>
Range = [0.0...5.0E9], [-6.6E-5...6.6E-5], [-6.6E-5...6.6E-5], [-6.6E-5...6.6E-5], [-6.6E-5…6.6E-5], [-6.6E-5…6.6E-5], [-6.6E-5…6.6E-5], [-2...4], [0...205], [0...205], [0...205], [0...1105];<LF>
Coordinate System = N/A;<LF>

3.4 EARTH IRRADIANCE DATA

This group is the 1 Hz full time resolution of the Earth signal irradiance measured by each radiometer. For every second, the dataset provides the demodulated power during an Earth view and the dark background offset interpolated to 1 second data rate. The Earth signal irradiance is subtracted by the background and scaled by the receiver responsivity to the absolute scale.

Note that the interpolation flag value in these datasets is a direct copy from the corresponding L1A radiometer power dataset. No additional interpolation is done after demodulation.

3.4.1 Band-A Earth Irradiance

This dataset contains the Band-A Earth irradiances, nominally measured by the radiometer RC2 in 1 Hz data rate. The Earth view power is directly from the demodulated radiometer power when the instrument is viewing the Earth. The dark view power is interpolated from the on-orbit measurements of the RC2 cavity power during observation of dark space. The Earth signal irradiance is equal to the negative value of the Earth view power subtracting the dark view power, and then scaled by the responsivity of the receiver into the absolute irradiance unit.

Table 45 – Band-A_EarthIrradiance data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.0E9	DSCOVR Epoch time at the midpoint of the boxcar window
EarthViewPower	float64	Watts	-6.6E5 …6.6E-5	The demodulated power from the receiver heater DAC when the instrument is viewing the Earth
DarkViewPower	float64	Watts	-6.6E5 …6.6E-5	The background power derived from observations of dark space

EarthIrradiance	float64	mW/m^2	0.0…100.0	The background subtracted power directly from the Earth and scaled into absolute irradiance
EarthRadiance	float64	$W/m^2/sr$	0.0…500.0	The Earth radiance converted from the irradiance by dividing the solid angle of the Earth
IsCopied	short	N/A	0…2	Interpolation flag value: 0 – original data from telemetry 1 – gap less than 6 seconds, use linear interpolation 2 – gap greater than 6 seconds and less than 4 shutter periods, copied from adjacent data

The following attributes (5) are defined for the BandA_EarthIrradiance data:

BandA_EarthIrradianceAttr = Radiometer 2 (Nominal Band A) Irradiance data; <LF>
Fields = Epoch Time, Earth View Demodulated Power, Dark View Demodulated Power, Earth Irradiance, Earth Radiance; <LF>
Units = Seconds, Watts, Watts, mW/m^2, $W/m^2/sr$; <LF>
Range = [0.0...5.0E9], [-6.6E-5...6.6E-5], [-6.6E-5...6.6E-5], [0.0…100.0], [0.0…500.0]; <LF>
Coordinate System = N/A; <LF>

3.4.2 Band-B Earth Irradiance

This dataset contains the Band-B Earth irradiances, nominally measured by the radiometer RC3 in 1 Hz data rate. The Earth view power is directly from the demodulated radiometer power when the instrument is viewing the Earth. The dark view power is interpolated from the on-orbit measurements of the RC3 cavity power during observation of dark space. The Earth signal irradiance is equal to the negative value of the Earth view power subtracting the dark view power, and then scaled by the responsivity of the receiver into the absolute irradiance unit.

Table 46 – Band-B_EarthIrradiance data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0 …5.0E9	DSCOVR Epoch time at the midpoint of the boxcar window

EarthViewPower	float64	Watts	-6.6E5 …6.6E-5	The demodulated power from the receiver heater DAC when the instrument is viewing the Earth
DarkViewPower	float64	Watts	-6.6E5 …6.6E-5	The background power derived from observations of dark space
EarthIrradiance	float64	mW/m^2	0.0…100.0	The background subtracted power directly from the Earth and scaled into absolute irradiance
EarthRadiance	float64	$W/m^2/sr$	0.0…500.0	The Earth radiance converted from the irradiance by dividing the solid angle of the Earth
IsCopied	short	N/A	0…2	Interpolation flag value: 0 – original data from telemetry 1 – gap less than 6 seconds, use linear interpolation 2 – gap greater than 6 seconds and less than 4 shutter periods, copied from adjacent data

The following attributes (5) are defined for the BandB_EarthIrradiance data:

BandB_EarthIrradianceAttr = Radiometer 3 (Nominal Band B) Irradiance data; <LF>
Fields = Epoch Time, Earth view Demodulated Power, Dark View Demodulated Power, Earth Signal Irradiance, Earth Signal Radiance; <LF>
Units = Seconds, Watts, Watts, mW/m^2, $W/m^2/sr$; <LF>
Range = [0.0...5.0E9], [-6.6E-5...6.6E-5], [-6.6E-5...6.6E-5], [0.0…100.0], [0.0…500.0]; <LF>
Coordinate System = N/A; <LF>

3.4.3 Band-C Earth Irradiance

This dataset contains the Band-C Earth irradiances, nominally measured by the radiometer RC1 in 1 Hz data rate. The Earth view power is directly from the demodulated radiometer power when the instrument is viewing the Earth. The dark view power is interpolated from the on-orbit measurements of the RC1 cavity power during observation of dark space. The Earth signal irradiance is equal to the negative value of the Earth view power subtracting the dark view power, and then scaled by the responsivity of the receiver into the absolute irradiance unit.

Table 47 – Band-C_EarthIrradiance data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.0E9	DSCOVR Epoch time at the midpoint of the boxcar window
EarthViewPower	float64	Watts	-6.6E5 …6.6E-5	The demodulated power from the receiver heater DAC when the instrument is viewing the Earth
DarkViewPower	float64	Watts	-6.6E5 …6.6E-5	The background power derived from observations of dark space
EarthIrradiance	float64	mW/m^2	0.0…100.0	The background subtracted power directly from the Earth and scaled into absolute irradiance
EarthRadiance	float64	$W/m^2/sr$	0.0…500.0	The Earth radiance converted from the irradiance by dividing the solid angle of the Earth
IsCopied	short	N/A	0…2	Interpolation flag value: 0 – original data from telemetry 1 – gap less than 6 seconds, use linear interpolation 2 – gap greater than 6 seconds and less than 4 shutter periods, copied from adjacent data

The following attributes (5) are defined for the BandC_EarthIrradiance data:

BandC_EarthIrradianceAttr = Radiometer 1 (Nominal Band C) Irradiance data; <LF>
Fields = Epoch Time, Earth View Demodulated Power, Dark View Demodulated Power, Earth Irradiance, Earth Radiance; <LF>
Units = Seconds, Watts, Watts, mW/m^2, $W/m^2/sr$; <LF>
Range = [0.0...5.0E9], [-6.6E-5...6.6E-5], [-6.6E-5...6.6E-5], [0.0…100.0], [0.0…500.0]; <LF>
Coordinate System = N/A; <LF>

3.5 BINNED AVERAGES DATA

This group is the Earth radiometer irradiance and the Earth photodiode current averaged over longer intervals of time. The corresponding geolocation data and the Earth solid angle is provided, as well. The sub-satellite longitude angle has a range of -180 to 180 degrees, where -180 degrees corresponds to 180 degrees west longitude. Similarly, -90 degrees sub-satellite latitude corresponds to 90 degrees south latitude.

3.5.1 Average Measurements at Four Hour Resolution

This dataset contains averages of the Earth irradiances as summed over a given four-hour period. A value of -999 indicates that there were not enough data points (< 60 %) within the time bin for a useful average to be computed.

The uncertainty of the irradiance reading for each band is calculated as the standard deviation divided by √N, where N is the (effective) number of independent measurements within the 4-hour averaging window. Note that it does not include the noise from the dark background measurement or the Type-B uncertainty from the absolute scale calibration.

Dataset Name EarthIrradiancesFourHour
Class: Irradiances

Table 48 – EarthIrradiancesFourHour data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.0E9	DSCOVR Epoch time at the midpoint of the averaging window
SolidAngle	float64	Steradians	0.0…12.6	The solid angle of the Sun-lit surface of the Earth as viewing from DSCOVR at the midpoint of the averaging window
EarthSolarAngle	float64	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the averaging window. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float64	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the averaging

				window
SubsatelliteLongitude	float64	Degrees	-180…180	The longitude of the subsatellite point at the midpoint of the averaging window
RadiometerBandA	float64	mW/m^2	-999.0… 100.0	Irradiance reading of Band A
BandAUncertainty	float64	mW/m^2	0.0… 100.0	Type A uncertainty in irradiance reading of Band A
RadiometerBandARadiance	float64	$mW/m^2/sr$	-999.0… 500.0	Radiance reading of Band A
BandB	float64	mW/m^2	-999.0… 100.0	Irradiance reading of Band B
BandBUncertainty	float64	mW/m^2	0.0… 100.0	Type A uncertainty in irradiance reading of Band B
RadiometerBandBRadiance	float64	$mW/m^2/sr$	-999.0… 500.0	Radiance reading of Band B
BandC	float64	mW/m^2	-999.0… 100.0	Irradiance reading of Band C
BandCUncertainty	float64	mW/m^2	0.0… 100.0	Type A uncertainty in irradiance reading of Band C
RadiometerBandCRadiance	float64	$mW/m^2/sr$	-999.0… 500.0	Radiance reading of Band C
Photodiode	float64	NanoAmp	-999.0… 100.0	Current reading of photodiode
PhotodiodeUncertainty	float64	NanoAmp	0.0… 100.0	Type A uncertainty in current reading of photodiode
PhotodiodeNormalized	float64	NanoAmp	-999.0…	Photodiode current normalized to the distance of

			100.0	the Lagrange 1 point

The following attributes (5) are defined for the EarthIrradiances_FourHour data:

EarthIrradiances_FourHour_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Solid Angle, Sun Angle (Sun-Earth-Vehicle), Latitude, Longitude, Average Band A Irradiance, Band A Irradiance Uncertainty, Average Band A Radiance, Average Band B Irradiance, Band B Irradiance Uncertainty, Average Band B Radiance, Average Band C Irradiance, Band C Irradiance Uncertainty, Average Band C Radiance, Average Photodiode Current, Photodiode Current Uncertainty, Average Photodiode Current Normalized to the Distance of the L1 Point; <LF>
Units = Seconds, Steradians, Degrees, Degrees, Degrees, mW/m^2, mW/m^2, $mW/m^2/sr$, mW/m^2, mW/m^2, $mW/m^2/sr$, mW/m^2, mW/m^2, $mW/m^2/sr$, NanoAmps, NanoAmps, NanoAmps; <LF>
Range = [0.0...5.0E9], [0.0…12.6], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...100.0], [0.0...100.0], [-999.0...500.0],[-999.0…100.0], [0.0…100.0], [-999.0…500.0], [-999.0…100.0], [0.0…100.0], [-999.0…500.0],[-999.0…100.0], [0.0…100.0], [-999.0…100.0]; <LF>
Coordinate System = Geographic latitude/longitude; <LF>

3.5.2 Average Measurements at Daily Resolutions

This dataset contains the average of the Earth irradiances for the current Julian day. A value of -999 indicates that there were not enough data points (< 85 %) within the time bin for a useful average to be computed.

The uncertainty of the irradiance reading for each band is calculated as the standard deviation divided by √N, where N is the (effective) number of independent measurements within the 1-day averaging window. Note that it does not include the noise from the dark background measurement or the Type-B uncertainty from absolute scale calibrations.

Dataset Name: EarthIrradiancesDaily
Class: Irradiances

Table 49 – EarthIrradiancesDaily data contents

Field Name	Data Type	Units	Range	Description
DscovrEpochTime	float64	Seconds	0…5.0E9	DSCOVR Epoch time at the midpoint of the averaging window
SolidAngle	float64	Steradians	0.0…12.6	The solid angle of the Sun-lit surface of the Earth as viewing from DSCOVR at the midpoint

				of the averaging window
EarthSolarAngle	float64	Degrees	0…45.0	DSCOVR-Earth-Sun angle at the midpoint of the averaging window. This angle should always be less than about 15 degrees once on station
SubsatelliteLatitude	float64	Degrees	-90…90	The latitude of the subsatellite point at the midpoint of the averaging window
SubsatelliteLongitude	float64	Degrees	-180… 180	The longitude of the subsatellite point at the midpoint of the averaging window
RadiometerBandA	float64	mW/m^2	-999.0… 100.0	Irradiance reading of Band A
BandAUncertainty	float64	mW/m^2	0.0… 100.0	Type A uncertainty in irradiance reading of Band A
RadiometerBandARadiance	float64	$mW/m^2/sr$	-999.0… 500.0	Radiance reading of Band A
BandB	float64	mW/m^2	-999.0… 100.0	Irradiance reading of Band B
BandBUncertainty	float64	mW/m^2	0.0… 100.0	Type A uncertainty in irradiance reading of Band B
RadiometerBandBRadiance	float64	$mW/m^2/sr$	-999.0… 500.0	Radiance reading of Band B
BandC	float64	mW/m^2	-999.0… 100.0	Irradiance reading of Band C
BandCUncertainty	float64	mW/m^2	0.0… 100.0	Type A uncertainty in irradiance reading of Band C
RadiometerBandCRadiance	float64	$mW/m^2/sr$	-999.0… 500.0	Radiance reading of Band C

Photodiode	float64	NanoAmp	-999.0… 100.0	Current reading of photodiode
PhotodiodeUncertainty	float64	NanoAmp	0.0… 100.0	Type A uncertainty in current reading of photodiode
PhotodiodeNormalized	float64	NanoAmp	-999.0… 100.0	Photodiode current normalized to the distance of the Lagrange 1 point

The following attributes (5) are defined for the EarthIrradiances_Daily data:

EarthIrradiances_Daily_Attr = Level 1B Irradiance data;<LF>
Fields = Epoch Time, Solid Angle, Sun Angle (Sun-Earth-Vehicle), Latitude, Longitude, Average Band A Irradiance, Band A Irradiance Uncertainty, Average Band A Radiance, Average Band B Irradiance, Band B Irradiance Uncertainty, Average Band B Radiance, Average Band C Irradiance, Band C Irradiance Uncertainty, Average Band C Radiance, Average Photodiode Current, Photodiode Current Uncertainty, Average Photodiode Current Normalized to the Distance of the L1 Point; <LF>
Units = Seconds, Steradians, Degrees, Degrees, Degrees, mW/m^2, mW/m^2, $mW/m^2/sr$, mW/m^2, mW/m^2, $mW/m^2/sr$, mW/m^2, mW/m^2, $mW/m^2/sr$, NanoAmps, NanoAmps, NanoAmps; <LF>
Range = [0.0...5.0E9], [0.0…12.6], [0.0...90.0], [-90.0...90.0], [-180.0...180.0], [-999.0...100.0], [0.0...100.0], [-999.0...500.0],[-999.0…100.0], [0.0…100.0], [-999.0…500.0], [-999.0…100.0], [0.0…100.0], [-999.0…500.0],[-999.0…100.0], [0.0…100.0], [-999.0…100.0]; <LF>
Coordinate System = Geographic latitude/longitude; <LF>

3.6 METADATA

Each file shall have a global attribute called “metadata” attached to it. This is an HDF attribute. The metadata attribute shall contain information about the product. It is a single character string with each name=value parameter pair delimited by a “;\n” character set. The <LF> character is defined as ASCII code 0A (hexadecimal). The metadata items are stored in a single HDF attribute in one continuous string delimited by “;\n”.

The values in the latitude and longitude fields shall be the geographic coordinates of the specified pixels in the Earth image. The centroids of the images are defined as the center of the Earth disk as it appears in the image.

Table 50 – L1B Metadata Attributes

Field Name	Data Type	Record Size (bytes)	Units	Range	Description

Name	String	114	N/A	N/A	Deep Space Climate Observatory National Institute of Standards and Technology Advanced Radiometer Level 1B Product
Summary	String	112	N/A	N/A	This dataset contains a NISTAR level 1B dataset. Contains summary radiometer, calibration, and geolocation data.
Keywords	String	96	N/A	N/A	DSCOVR, NISTAR, radiometer, L1B, lagrange, infrared, thermal, radiation, L-1, radiometer, cavity
Project	String	30	N/A	N/A	Deep Space Climate Observatory
Producer_granule_id	String	34	N/A	N/A	The name of the HDF file.
Level1A_Product_File_Name	String	34	N/A	N/A	The name of the HDF file that contains the level 1a product from which this level 1b product was derived
File_creation_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the current day
Beginning_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the beginning day from which level 1b data was tabulated

End_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the final day up to which level 1b data was tabulated.
Granule_version	String	5	N/A	01…99	The processing version number of the product. For decimal version numbers, an additional string "_d" is appended, where d represents the decimal part
Comment	String	40	N/A	N/A	The miscellaneous text comment on the product. Null value is "NULL".
Centroid_latitude	String	7	Degrees	-90… 90	The latitude of the image centroid, E.g., 37.25. Null value="NULL"
Centroid_longtidue	String	8	Degrees	-180… 180	The longitude of the image centroid E.g., -173.28. Null value="NULL"
Percent_data_available	String	4	Percentage	0… 100	Indicates the percentage of data expected in a 24-our interval actually available in the product
Data_quality	String	5	N/A	GOOD or BAD	Indicates if the quality of the data in the product is good enough for scientific analysis (GOOD) or not (BAD)

Metadata Text Format:

Name=Deep Space Climate Observatory National Institute of Standards and Technology Advanced Radiometer Level 1B Product;<LF>
Summary=This dataset contains a NISTAR level 1B dataset. Contains summary radiometer, calibration, and geolocation data. ;<LF>
Keywords=DSCOVR, NISTAR, radiometer, L1B, lagrange, infrared, thermal, radiation, L-1, radiometer, cavity;<LF>
Project=Deep Space Climate Observatory;<LF>
Producer_granule_id= nist_1b_xxxxxxxx_xxxxxxx_xx.h5;<LF>
Level1_Product_File_Name= nist_1a_xxxxxxxx_xxxxxxx_xx.h5;<LF>
Current_Date= yyyy-mm-dd_hh:mm:ss;<LF>
Begin_Date= yyyy-mm-dd_hh:mm:ss;<LF>
End_Date= yyyy-mm-dd_hh:mm:ss;<LF>
Granule_version= xx/xx_x;<LF>
Comment=NISTAR Level 1B Data.;<LF>
Centroid_latitude=+/-xx.xx;<LF>
Centroid_longitude=+/-xxx.xx;<LF>
Percent_data_available= xxx;<LF>
Data_quality= GOOD/BAD;<LF>

4 NISTAR LEVEL 1B FILTERED DATA PRODUCT

4.1 PRODUCT OVERVIEW

The NISTAR level 1B filtered data products are generated from level 1B products, which include the Earth radiance and photodiode Earth current normalized to 1 AU distance. The filtered data is reported at a 10 second data rate to reduce data volume. The level 1B filtered data product eliminates the excessive high-frequency (> 0.1 mHz) noise in the level 1B Earth radiance data using an optimized digital low-pass filter. The filter design is based on a 4^{th} order Chebyshev Type II filter, with the input data filtered in both the forward and reverse temporal directions to zero out the phase shifts, which squares the transfer function making it effectively an 8^{th} order filter. The coefficients of the Chebyshev filter are also stored in the data product. Compared with the original level 1B 4-hour running averaged product, this product provides better noise suppression while preserving data at scientifically significant frequencies. More details can be found in the NISTAR Data Quality Report. Note that the sampling frequency of the level 1B filtered data is reduced from 1 Hz to 0.1 Hz to reduce numerical rounding errors in digital filtering. The level 1B filtered data product includes the Earth radiance of a month, from 12:00:00.00h of the first day of the month to 11:59:59.99h of the first day of next month.

As with other level 1B products, the number of significant digits in all level 1B filtered datasets has been adjusted to eliminate excessive digits.

Table 51 – L1B Filtered Data Group Types

Group	Contents
Earth_Radiance_Filtered	Contains the filtered Earth radiance (Band A, B and C) and the down-sampled photodiode current both at a 10 seconds cadence

Filter_Coefficients	Contains the coefficients of the Chebyshev Type II low-pass filter

4.2 DATA VOLUMES

Each month of NISTAR level 1B filtered data product contains up to approximately 19 MB of uncompressed data. The values given in Table 52 are the maximum possible sizes. With compression in HDF5, the actual size of the level 1B filtered data product is typically less than 5 MB.

Table 52 - L1B filtered data volumes by group and dataset

Group	Dataset	Record Size (bytes)	Number Records	Object Size (bytes)
Earth_Radiance_Filtered	Band A (Total)	18	267,840	4,821,120
	Band B (Shortwave)	18	267,840	4,821,120
	Band C (NIR)	18	267,840	4,821,120
	Photodiode_Current	18	267,840	4,821,120
Filter_Coefficients	4thOrderChebyshevTypeII	16	4	64
Metadata	Metadata Attr	365	1	365
Approximate Total Size				19,284,909

4.3 EARTH RADIANCE FILTERED DATA

This group is the result of the digital filtering of the input L1B Earth radiance, as well as the filtered photodiode current. Unlike the averaged L1B irradiance/radiance data product, there is no value of -999 to indicate unavailable data entries.

4.3.1 Band A (Total)

This dataset contains the filtered Earth radiance data in the Band A (total channel).

Table 53 – Band A (Total) data contents

Field Name	Data Type	Units	Range	Description
DSCOVREpochTime	float64	Seconds	0 …5.0E9	DSCOVR Epoch time down-sampled at a 10 second cadence
EarthRadiance	float64	$mW/m^2/sr$	0 … 500.0	The filtered Earth radiance in the total channel

isInterpolated	short	N/A	0…3	Interpolation flag value: 0 – original data from telemetry 1 – gap less than 6 seconds, use linear interpolation 2 – gap greater than 6 seconds and less than 4 shutter periods, copied from adjacent data

The following attributes (5) are defined for the Band A (Total) data:

Band A (Total) Attr = Level 1B filtered radiance data;<LF>
Fields = Epoch Time, Band A Earth Radiance, Interpolation Flag Value; <LF>
Units = Seconds, mW/m^2/sr, N/A; <LF>
Range = [0.0...5.0E9], [0.0…500.0], [0...3]; <LF>
Coordinate System = N/A; <LF>

4.3.2 Band B (Shortwave)

This dataset contains the filtered Earth radiance data in the Band B (shortwave channel).

Table 54 – Band B (Shortwave) data contents

Field Name	Data Type	Units	Range	Description
DSCOVREpochTime	float64	Seconds	0 …5.0E9	DSCOVR Epoch time down-sampled at a 10 second cadence
EarthRadiance	float64	mW/m^2/sr	0 … 500.0	The filtered Earth radiance in the shortwave channel
isInterpolated	short	N/A	0…3	Interpolation flag value: 0 – original data from telemetry 1 – gap less than 6 seconds, use linear interpolation 2 – gap greater than 6 seconds and less than 4 shutter periods, copied from adjacent data 3 – gap greater than 4 shutter periods and less than 2 hours, scaled from corresponding

				photodiode current

The following attributes (5) are defined for the Band B (Shortwave) data:

Band B (Shortwave) Attr = Level 1B filtered radiance data;<LF>
Fields = Epoch Time, Band B Earth Radiance, Interpolation Flag Value; <LF>
Units = Seconds, mW/m^2/sr, N/A; <LF>
Range = [0.0...5.0E9], [0.0…500.0], [0...3]; <LF>
Coordinate System = N/A; <LF>

4.3.3 Band C (NIR)

This dataset contains the filtered Earth radiance data in the Band C (near infrared channel).

Table 55 – Band C (NIR) data contents

Field Name	Data Type	Units	Range	Description
DSCOVREpochTime	float64	Seconds	0 …5.0E9	DSCOVR Epoch time down-sampled at a 10 second cadence
EarthRadiance	float64	mW/m^2/sr	0 … 500.0	The filtered Earth radiance in the near infrared channel
isInterpolated	short	N/A	0…3	Interpolation flag value: 0 – original data from telemetry 1 – gap less than 6 seconds, use linear interpolation 2 – gap greater than 6 seconds and less than 4 shutter periods, copied from adjacent data

The following attributes (5) are defined for the Band C (NIR) data:

Band C (NIR) Attr = Level 1B filtered radiance data;<LF>
Fields = Epoch Time, Band C Earth Radiance, Interpolation Flag Value; <LF>
Units = Seconds, mW/m^2/sr, N/A; <LF>
Range = [0.0...5.0E9], [0.0…500.0], [0...3]; <LF>
Coordinate System = N/A; <LF>

4.3.4 Photodiode_Current

This dataset contains the filtered Earth photodiode current normalized to the distance to Lagrange 1 point.

Table 56 – Band C (NIR) data contents

Field Name	Data Type	Units	Range	Description
DSCOVREpochTime	float64	Seconds	0 …5.0E9	DSCOVR Epoch time down-sampled at a 10 second cadence
EarthPDCurrent1AU	float64	NanoAmp	0 … 500.0	Photodiode current normalized to the distance of the Lagrange 1 point
isInterpolated	short	N/A	0…3	Interpolation flag value: 0 – original data from telemetry 1 – gap less than 6 seconds, use linear interpolation 2 – gap greater than 6 seconds and less than 2 hours, interpolated by polynomial fit

The following attributes (5) are defined for the Photodiode_Current data:

Photodiode_Current_Attr = Level 1B downsampled photodiode current data;<LF>
Fields = Epoch Time, Earth PD Current, Interpolation Flag Value; <LF>
Units = Seconds, NanoAmp, N/A; <LF>
Range = [0.0...5.0E9], [0.0…500.0], [0...3]; <LF>
Coordinate System = N/A; <LF>

4.4 FILTER COEFFICIENT DATA

This group is the coefficients of the digital Chebyshev Type II low-pass filter with a sampling frequency of 0.1 Hz. The filter is represented using a rational transfer function defined by the numerator and denominator coefficients b and a, with a[0] normalized to 1. The actual digital filter applied to the input Earth radiance data has a squared transfer function of the Chebyshev filter due to the forward-backward filtering scheme. More details on the design and performance of the filter can be found in the NISTAR Data Quality Report.

4.4.1 4th Order Chebyshev Type II

This dataset contains the coefficients of the 4th order Chebyshev Type II filter described above.

Table 57 – 4th Order Chebyshev Type II data contents

Field Name	Data Type	Units	Range	Description
a	float64	N/A	-1.0 … 1.0	The denominator coefficients a
b	float64	N/A	-1.0 … 1.0	The numerator coefficients b

The following attributes (5) are defined for the 4th Order Chebyshev Type II data:

4th Order Chebyshev Type II Attr = Chebyshev Type II low-pass filter coefficient data;<LF>
Fields = a, b; <LF>
Units = N/A, N/A; <LF>
Range = [-1.0…1.0], [-1.0…1.0]; <LF>
Coordinate System = N/A; <LF>

4.5 METADATA

Each file shall have a global attribute called “metadata” attached to it. This is an HDF attribute. The metadata attribute shall contain information about the product. It is a single character string with each name=value parameter pair delimited by a “;\n” character set. The <LF> character is defined as ASCII code 0A (hexadecimal). The metadata items are stored in a single HDF attribute in one continuous string delimited by “;\n”.

Table 58 – L1B Filtered Metadata Attributes

Field Name	Data Type	Record Size (bytes)	Units	Range	Description
Name	String	114	N/A	N/A	Deep Space Climate Observatory National Institute of Standards and Technology Advanced Radiometer Level 1B Product

Summary	String	112	N/A	N/A	This dataset contains a NISTAR level 1B dataset. Contains summary radiometer, calibration, and geolocation data.
Keywords	String	96	N/A	N/A	DSCOVR, NISTAR, radiometer, L1B, lagrange, infrared, thermal, radiation, L-1, radiometer, cavity
Project	String	30	N/A	N/A	Deep Space Climate Observatory
Producer_granule_id	String	34	N/A	N/A	The name of the HDF file.
File_creation_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the current day
Beginning_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the beginning day from which level 1b data was tabulated
End_of_data_date	String	21	N/A	N/A	yyyy-mm-dd_hh:mm:ss date/time (UTC) of the final day up to which level 1b data was tabulated.
Granule_version	String	5	N/A	01…99	The processing version number of the product. For decimal version numbers, an additional string "_d" is appended, where d represents the decimal part
Comment	String	40	N/A	N/A	The miscellaneous text comment on the product. Null value is "NULL".

Metadata Text Format:

Name=Deep Space Climate Observatory National Institute of Standards and Technology Advanced Radiometer Level 1B Product;<LF>

Summary=This dataset contains a NISTAR level 1B dataset. Contains summary radiometer, calibration, and geolocation data. ;<LF>
Keywords=DSCOVR, NISTAR, radiometer, L1B, lagrange, infrared, thermal, radiation, L-1, radiometer, cavity;<LF>
Project=Deep Space Climate Observatory;<LF>
Producer_granule_id= nist_1b_xxxxxxxx_xxxxxxx_xx.h5;<LF>
Level1_Product_File_Name= nist_1a_xxxxxxxx_xxxxxxx_xx.h5;<LF>
Current_Date= yyyy-mm-dd_hh:mm:ss;<LF>
Begin_Date= yyyy-mm-dd_hh:mm:ss;<LF>
End_Date= yyyy-mm-dd_hh:mm:ss;<LF>
Granule_version= xx/xx_x;<LF>
Comment=NISTAR Level 1B Data.;<LF>

5 REFERENCES

Pedro Ramon Escobal, *Methods of Orbit Determination*, John Wiley & Sons, Inc. 1965

DSCOVR NISTAR Instrument Levels 1 and 2 Science Data Products Data Format Control Book

Appendix A. Abbreviations and Acronyms

Abbreviation/ Acronym	DEFINITION
ADC	Analog to Digital Converter
AppID	Application ID
ASCII	American Standard Code for Information Interchange
ASDC	Atmospheric Science Data Center
BOL	Beginning of Life
BNOM	Bridge Null Offset Measurement
cm	Centimeters
DAC	Digital to Analog Converter
DFCB	Data Format Control Book
DSCOVR	Deep Space Science Observatory
DSOC	DSCOVR Science Operations Center
FW	Filter Wheel
HDF	Hierarchical Data Format
HS	Heat Sink
Hz	Hertz
ITOS	Integrated Test and Operations System
L1A	Level 1A
L1B	Level 1B
MDAC	Multiplying Digital to Analog Converter
N/A	Not Applicable
NIST	National Institute of Standard and Technology
NISTAR	NIST Advanced Radiometer
nm	Nanometers
PD	Photodiode
PID2	Proportional Integral Derivative 2
PTC	Positive temperature coefficient
PWA	Printed Wiring Assembly
QHSS	Quad High Speed Serial
RC	Receiver Cavity, usually followed by 1, 2, or 3
SI or Si	Silicon
UTC	Universal Time, Coordinated
VC	Virtual Channel
VDC	Volts of direct current
W	Watts